# *MATE ROV Competitions:*
# *Providing Pathways to the Ocean STEM Workforce*
# Annual Report
# September 1, 2009 through June 30, 2010

## EXECUTIVE SUMMARY

### *About the MATE Center*

The Marine Advanced Technology Education (MATE) Center was established as an Advanced Technological Education (ATE) Center of Excellence in 1997 with funding from the National Science Foundation (NSF) and currently continues as an NSF ATE Resource Center. Headquartered at Monterey Peninsula College (MPC) in Monterey, California, the Center is a national partnership of community colleges, high schools, universities, informal educational organizations, research institutions, marine industries, and working professionals. MATE's mission is to improve marine technical education and increase the number of skilled technical professionals who enter ocean-related occupations.

### *Project Overview*

*MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce* uses the MATE Center's remotely operated vehicle (ROV) competition network as the vehicle to reach, engage, and support the participation of middle schools in ocean-related science, technology, engineering, and math (STEM) learning experiences. It creates and disseminates career information and guidance tools to students to help them to make the transition from middle school through high school to college and into the workplace. It reaches out to, communicates with, and engages parents in project activities, including professional development and student workshops and competition events. It maintains a cyberlearning community that promotes access to resources and encourages communication and collaboration across all grade levels. Finally, the project evaluates the impact of these activities and contributing those findings to the knowledge base about STEM education, particularly as it applies to traditionally underrepresented groups. (The project uses the term "underrepresented" to refer to gender, ethnic minorities, and/or socioeconomically disadvantaged.)

Specifically, *MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce* expands the MATE Center's successful ROV competition program to middle schools. It uses MATE's existing regional competition network as the mechanism for building and strengthening ocean STEM-related career pathways. Since the progressive nature of the MATE competition classes (SCOUT>RANGER>EXPLORER) parallels the education pipeline, middle school students who become engaged and excited about engineering and fabricating ROVs can continue to do so as they move on to high schools that already have (or will have as a result of the broader impacts of this grant work) their own ROV programs. From high schools, these students can continue with their ROV work and pursue STEM degree programs as they take advantage of opportunities at postsecondary institutions. Along the way, they can access information and resources to complement their learning and connect with like-minded students, teachers, and working professionals through the cyperlearning center.

## ACTIVITIES FOR YEAR 1

The activities for Year 1 revolved around the four objectives (and their respective strategies) as stated in the proposal.

***Objective 1:*** Build the support infrastructure for an entry-level ("SCOUT") ROV competition class by a) providing professional development and student support workshops in afterschool and informal settings; and b) developing, adapting, and enhancing ROV-focused STEM curriculum materials.

**Activities for Year 1:**

- Provide 40 middle school teachers who serve underrepresented students with 28 hours of professional development, to include one "take-home" ROV per teacher.
- Offer one entry-level Summer Institute for Faculty Development that provides 20 of these teachers with an additional 56 hours, for a total of 84 hours.
- Provide 400 middle school students with a minimum of 20 hours of instruction and hands-on STEM learning experiences.
- Produce drafts of 4 middle school curriculum modules and test them with the teachers participating in the entry-level Summer Institute.
- Implement a beginner level ("SCOUT") competition class at four of MATE's existing regional contests within the U.S.

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***Objective 2:*** Increase ocean STEM career awareness and present trajectories to those careers for middle and high school audiences.

**Activities for Year 1:**

- Gather information on existing middle school career resources and assess the career information needs of middle school teachers, parents, and students.
- Provide hard copies of the *Guide to Marine Science and Technology Programs in Higher Education* to each middle and high school participating in the 2010 ROV competitions.
- Couple efforts with local postsecondary institutions to disseminate career information to the target middle school audience.

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***Objective 3:*** Build a cyberlearning center to a) foster collaboration and increase communication among students, educators, parents, and working professionals; and b) improve access to STEM instructional resources.

**Activity for Year 1:**

- Develop and launch ROVER (ROV Education and Resources), a continuously evolving and expanding cyberlearning center that uses the latest web technologies and social media tools to engage and support users searching for information, resources, and connections.

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***Objective 4:*** Evaluate and track project participants to determine the impact on a) students' STEM knowledge, skill development, and inclination to pursue STEM education and careers; and b) teachers' confidence in facilitating STEM learning experiences and delivering career information.

**Activities for Year 1:**

- Create and refine evaluation protocols.

- Create and analyze pre/post professional development workshop surveys.
- Generate and analyze post-competition surveys.
- Conduct interviews of project participants, including the PI/Co-PIs and regional coordinators.
- Data/records collection/review.
- Monitor the development and revision of tools, curriculum, website.
- Provide formative advice to the project PI/Co-PIs.
- Analyze data and write Grant Year 1 evaluation report.

## MAJOR ACCOMPLISHMENTS

Between September 1, 2009 and June 30, 2010 the MATE Center and its ITEST project partners:

- Offered 8 professional development workshops to 39 middle school teachers who serve underrepresented students. These workshops provided a minimum 8 hours of professional development and one "take-home" ROV per teacher.
    - Broader impact: Two (Monterey and New England) regions leveraged outside sources for additional funding to provide 13 high school teachers with 8 hours of professional development, which included one take-home ROV per teacher.
- Follow-up student workshops and other activities (such as presentations by industry professionals and classroom visits by college students and industry professionals) provided these 39 middle school teachers with an additional minimum 20 hours of professional development, for a total of 28 hours.
- Offer one entry-level Summer Institute for Faculty Development that will provide 3 of these teachers with an additional 56 hours, for a total of 84 hours.
    - Broader impact: We did not reach our target number of 20 of these teachers. However, in addition to 3 teachers from ITEST regions, we will serve 6 other middle school teachers, 5 of whom serve underrepresented students (one serves a rural population). In addition, 1 faculty member at the Southern California regional ITEST lead institution; 2 teachers from high schools that Monterey ITEST middle schools feed into; 1 high school teacher from the American School in Japan; and a curriculum development specialist from the Shedd Aquarium (for a total of 14 teachers) will participate.
- Offered 16 student workshops and nearly 100 classroom visits to provide more than 400 middle school students with a minimum of 20 hours of instruction and hands-on STEM learning experiences. An additional 57 students received 4 hours of hands-on ROV design and building instruction. These activities also served as venues to deliver career information, which included "career profiles" presented by industry professionals.
    - Broader impact: One regional's (Pacific Northwest) "classroom visits" were often all-day events where information was presented to multiple classes and afterschool clubs of 20 students or more. While the intention was not to engage and support all of these students in carrying out ITEST ROV activities, through its school visits the Pacific Northwest impacted more than 1,000 students.
- Formed a collaboration with the Shedd Aquarium to combine curriculum development efforts. (A Shedd curriculum development specialist will attend the entry-level Summer

Institute to gain a better understanding and appreciation of the needs and challenges of middle school teachers implementing ocean STEM activities in their classrooms.)

- Implemented a beginner level ("SCOUT") competition class event within 4 of MATE's existing regional areas within the U.S.
- Gathered information on existing middle school career resources and assessed the career information needs of middle school teachers, parents and students via from the Curriculum and Cultural Advisory Committee and a focus group of middle school teachers.
- By September 2010, will have worked in partnership with the Marine Technology Society to provide hard copies of the *Guide to Marine Science and Technology Programs in Higher Education* to the 282 middle and high schools that participated in the 2010 ROV competitions.
- Connected with local postsecondary institutions to combine career information efforts. Used the professional development and student workshops, classroom visits, and competition events as dissemination vehicles.
- Developed and will launch in September of 2010 the ROVER cyberlearning center that features curriculum materials, design and building resources, a communication hub, photos, videos, competition information, links to other ROV and ocean STEM-related information and resources, connections to MATE's social media sites, a robust back-site administrator management area, and much more.
- Developed and refined evaluation protocols, conducted data collection (surveys, structured interviews, observations, records review, etc.), cleaned and analyzed data, and produced a report with preliminary results, including an analysis of the findings by demographic factors.
- Held one regional coordinators' meeting to debrief the 2009 competition season; present plans for the 2010 competition; provide details about the project's proposed activities; and share plans, discuss strategies, ideas and challenges, and gather feedback to help shape ITEST grant implementation.
- Held one meeting of the Curriculum and Cultural Advisory Committee where advisors provided extremely helpful (and much needed) information and insight into middle school professional development, including best practices for designing and carrying out teacher workshops, creating curriculum, securing administrative support, and more. Advisors also shared best practices for reaching underrepresented student audiences.
- Presented information about *MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce* and/or delivered hands-on ROV workshops at 10 conferences, meetings, community events, and other outreach activities, reaching more than 380 educators, students, working professionals, and community members.
- Published articles and information about MATE's ITEST project in 6 journals, newspapers, and other print or electronic media outlets.

## SUMMARY OF WHAT WORKED, WHAT DIDN'T WORK, AND LESSONS LEARNED

Overall, the strategy of modifying, enhancing, and expanding the Monterey region's existing competition model to engage middle schools serving underrepresented students was successful. All four of the Grant Year 1 regions developed their own unique implementation methods to offer professional development in ROV design and building to teachers and provide instruction, hands-

on experiences, and career information to students. All four of the regions held SCOUT class competition events where teachers and students who had received these resources participated.

Demographic data collected from three regions (Monterey, the Pacific Northwest, and New England) show that at least two (Monterey and New England) reached minorities. In terms of gender, while most regions' participants were male, Monterey area schools reported that half of their participants were female. While socioeconomic data was not available for most, one New England regional middle school reported that all of their students qualified for free or reduced lunch.

Teacher, student, and parent surveys showed overall positive results. All of the teachers responding to post-professional development workshop surveys stated that they felt more confident facilitating STEM learning experiences as a result of the training. The vast majority also felt more committed to participating in the competition.

In post-competition student surveys, respondents reported an increased knowledge of marine-related STEM careers as a result of the ROV project. The majority of the students stated that their ROV project made them want to learn more about ocean STEM and had increased their interest in such a career.

The results of parent surveys were equally as encouraging. The vast majority stated that building an ROV made their child more interested in STEM, and that participation in the program had made it easier to picture their child in a STEM career. Seventy percent of parents reported that their children were better able to work with others due to their involvement in the ROV project and that their child's self-confidence improved. More than half of the parents reported that building an ROV contributed to improving their child's grades in science, math, computer science, and engineering/robotics. The parents' responses underscore the important role that they play in providing valuable information about the program's impact and in helping to shape and support their child's future.

There were things that worked well and things that did not work well in each region. For example, what worked well was each region's established network of partnerships and outside funding sources. These connections enabled each region to spin up and support grant activities fairly quickly. Because postsecondary institutions are the lead (or supporting) coordinators in each of these regions, it was easy to couple career information and dissemination efforts. The sources of outside funding allowed for the broader impact of engaging high schools that many of the middle school students will attend, building both capacity and the STEM educational pathway. The fact that each region started or significantly increased the number of teams participating in their SCOUT class events is another measure of success.

A common challenge for all regionals was the level of instruction to provide the teachers, particularly in the area of electricity, simple circuits, and soldering. Strategies for ensuring that participants receive "enough" instruction in these critical areas will be discussed during the 2010 regional coordinators' meeting.

In Monterey, the project PI also serves as the coordinator overseeing regional implementation. Managing PI responsibilities that included providing oversight and support to the other regionals while trying to carry out activities in support of Objective 1 was taxing. Some of the regional coordinating duties will be shifted to other staff in Grant Year 2. Both the Pacific Northwest and the New England region noted difficulties in demonstrating to teachers the connection between science in the classroom and the ROV project. We will make sure that the curriculum being developed under Objective 1 contains information and activities that will help to make this connection.

One regional had difficulties administering teacher workshop surveys; advance planning will help to address this issue in Year 2. A discussion of ways to make demographic data collection less

of a burden for both coordinators and schools will be led by the project's evaluator during the 2010 regional coordinators' meeting.

Progress was made towards developing a middle school curriculum that uses ROVs as a way to engage and instruct students in STEM. The most significant step is having a curriculum development specialist on board who is also intimately familiar with the ROV competition program and participants' needs. We anxiously await the draft product and the opportunity to test it in Year 2.

Recruiting middle school teachers from each region for the entry-level Summer Institute proved challenging. Next year promotion and recruitment, including making contacts directly with the principals and other administrators at the schools, will begin much earlier.

The Curriculum and Cultural Advisory Committee was invaluable in providing resources and insight to inform the process of adapting OceanCareers.com and the *Exploring Ocean Careers* online course for the target audience. The website and course will get considerable attention this fall.

ROVER is up and running, with information, resources, links to outside sources, social media outlets, and more. The principal of Clear Science, Inc., the lead on this effort, has worked with the MATE Center for years and therefore is very familiar with our programs. He also manages the MATE Center's website, which made him a natural choice to lead the ROVER's development. The site will go live in September 2010.

Similarly, one of the project's evaluators, Candiya Mann, also serves as the evaluator for the MATE Center grant. As with Clear Science, this brings the advantage of history and familiarity with the PI/Co-PIs and their programs and provides the foundation for a good understanding of MATE's ITEST work.

Protocols and survey tools were developed and utilized to gather information to answer the evaluation's research questions. Several evaluation successes as well as challenges are noted above, described under Objective 4 below, and presented in detail within the evaluation report. The evaluation report is included with the Addenda.

## DETAILED DESCRIPTIONS OF ACTIVITIES AND FINDINGS ORGANIZED BY OBJECTIVE

The bulk of the work undertaken in the first year of the grant focused on Objective 1 and the evaluation of it, which is covered under Objective 4. Therefore, the majority of the text below describes this objective. Accomplishments and progress made to date for Objectives 2 and 3 are included.

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***Objective 1:*** **Build the support infrastructure for an entry-level ("SCOUT") ROV competition class by a) providing professional development and student support workshops in afterschool and informal settings; and b) developing, adapting, and enhancing ROV-focused STEM curriculum materials.**

At the time the proposal was submitted, there were 12 U.S.-based MATE regional competitions (since that time, that number has increased to 15, bringing the total number of MATE regional ROV competitions (U.S-based and foreign) to 19). The Monterey Bay regional, organized by the MATE Center in partnership with a host of other, local marine-related organizations, is the oldest member of the regional competition network and the only regional with a well-established support infrastructure for SCOUT class teams. This infrastructure includes professional development

workshops for teachers, topic-specific (e.g. camera waterproofing, wiring, and pool practice) workshops for students, instructional materials, a pool of "seasoned" volunteers, and an event that brings together more than 300 students, teachers, parents, and working professionals. Parents are invited and encouraged to become involved in all of these activities. As a result, nearly 20 parents currently serve as the primary mentor for their child's competition team(s).

The proposed implementation plan for this objective uses Monterey's support infrastructure as the base model that regional coordinators then modify, improve, and expand to the targeted middle school audience so that it plays upon their local collective strengths, uses local resources, and best suits the needs of their local audience. The implementation schedule started with the regions that are best positioned to successfully carry out this work. Based on the results of MATE's workforce studies, these regions are also experiencing significant workforce challenges. The schedule is as follows:

- Year 1: Monterey Bay, Southern California, Pacific Northwest, and New England
- Year 2: Hawaii-Oahu, Hawaii-Big Island, Texas, and Mid-Atlantic
- Year 3: Florida, Southeast, Great Lakes, and Midwest

One aspect of the project that we see as a strongpoint is that each region will develop its own unique approach to reaching and engaging the target audience and carrying out the grant activities. What will result are distinct models of implementation, each with their own strengths, challenges, and lessons learned for next year that can then be shared across the MATE regional competition network and with the larger STEM education community.

While there were some similarities, Monterey Bay, Southern California, Pacific Northwest, and New England each took different approaches to regional grant implementation. What follows are descriptions of the activities and findings, organized by region, related to the following strategies of Objective 1:

**● Provide professional development workshops for middle school teachers who serve large populations of underrepresented students across the regional competition network.**

**● Provide these teachers and their students with follow-up support workshops.**

**● Add an entry-level (SCOUT) class to the regional competition network.**

A summary of demographic and impact information as well as MATE Center support is provided at the end of the regional descriptions.

**MONTEREY**

The Monterey Bay Regional ROV Contest is organized by the MATE Center and Monterey Peninsula College (MPC). The event is supported by MPC's Technology Preparation ("Tech Prep") Program, the MPC Foundation, the Monterey Bay Aquarium Research Institute, the MTS-Monterey section, and the Monterey Bay National Marine Sanctuary.

Jill Zande is the MATE Center Associate Director/Co-PI and the ITEST grant PI. Jill, along with Kim Swan from the Monterey Bay Aquarium, co-coordinates the Monterey Bay regional. In addition to serving as the ITEST grant PI, Jill oversees Monterey's ITEST activities. Matt Gardner, a consultant for the MATE Center, is the MATE competition program's technical manager and head rules judge. Matt also coordinates the technical aspects and poolside operations at the Monterey regional. Jeremy Hertzberg, the MPC Automotive Technology Department's laboratory technician and a part-time instructor, provides additional technical support. The MPC fiscal office is the fiscal agent for the ITEST funds.

Regional implementation began in the fall. Through the Monterey Bay Aquarium's Community Partnership Program, Jill was connected with the afterschool program director for the Pajaro

Valley Unified School District (PVUSD). She made several visits to the PVUSD offices to present information about the grant and the Monterey ITEST program to the director and his staff of middle and high school afterschool site coordinators (each school in the district has one). The district's Gifted and Talented Education (GATE) Program director also learned about the program and asked Jill to present information to her, a member of her staff, and several interested parents. The afterschool site coordinators were asked to contact Jill if they were interested in participating. The GATE Program director (and parents) actively promoted the program through flyers and its website to GATE teachers, instructing them to contact Jill if they were interested

Through Monterey High School's Monterey Academy of Oceanographic Sciences (MAOS), Jill was connected with the "extended learning" director for the Monterey Peninsula Unified School District (MPUSD), who invited Jill to present the ITEST program to middle and high school Afterschool Academy (ASA) site coordinators (like, PVUSD, there is one at each school). After the presentation, the director told the ASA middle school site coordinators that they would participate in the program and instructed them to identify teachers at their schools who would teach the ASA ROV "courses."

MPC also supported teacher recruitment. The President/Superintendent of MPC asked Jill to present the ITEST program at his regularly scheduled meeting with local school district superintendents and high school principals.

As a result of these efforts, two schools (one an elementary school covering grades K-6 and the other a middle school) within PVUSD and the five middle schools of MPUSD signed up to take part in a professional development workshop in November. The PVUSD elementary school sent one science teacher, one parent mentor, and one local industry mentor; the PVUSD middle school sent one science teacher who had been involved with the ROV competition previously. The MPUSD middle schools sent three teachers (including one who was currently involved in the ROV competition), four ASA coordinators, and the extending learning director. The ASA site coordinator for Monterey High School also attended, with the idea that the workshop experience would allow him to better connect with MAOS' existing ROV program as well as assist the middle school that was geographically closet.

Jill, Matt, and Jeremy lead the workshop, presenting information on ROV "anatomy," buoyancy, simple circuits, payloads, and more. Jill also shared career information in the form of OceanCareers.com; MPC engineering, computer science, and marine science and technology program brochures; student services available on campus; and a "How to Get to College" information sheet created by California State University. Each teacher/ASA site coordinator left the workshop with a working ROV that they had designed and built themselves.

During the workshop, Jill also presented the proposed ROV project implementation plan that she and Kim had developed based on what they knew at the time about PVUSD and MPUSD afterschool programs. The plan consisted of an afterschool ROV "course" that met two days per week for six weeks. Jill and Kim had put together a sample course outline that indicated where in-classroom support would most likely be needed – and available. After getting buy-in from the participants, the plan would then provide each school with materials and supplies as well as the tools and equipment needed to design and build five student ROVs. In addition, they would receive a DVD of curriculum resources, including PowerPoint presentations and videos. These resources would be delivered to their schools by the end of January 2010 so that the course could begin in early February, allowing plenty of "wiggle" room to make sure that the students were prepared for the SCOUT class competition event in April.

Starting in mid-February, Matt, a retired mechanical engineer/volunteer, and two MPC students visited two of the MPUSD middle school classrooms on an as-needed basis. The MAOS ROV teacher and his students reached out to the nearby middle school to offer them technical assistance and access to Monterey High School's swimming pool. One middle school received assistance from a student from California State University Monterey Bay's (CSUMB) service

learning program. Jeremy provided technical and troubleshooting support via e-mail, phone calls, and invites to the Automotive Technology facility at MPC. Jill purchased additional supplies for schools that requested them. The PVUSD middle school teacher leveraged his relationship with the Math Engineering Science Achievement (MESA) program to get additional resources as well as technical support.

All of the schools were given the opportunity to take part in two pool practice sessions at the MPC swimming pool. Three of those schools took advantage of the in-water time and troubleshooting assistance provided during the sessions by Matt, Jeremy, MPC students, and industry volunteers.

The Monterey region held its SCOUT class competition event in conjunction with the existing Monterey Bay Regional ROV Contest on Saturday, April 24th, 2010. All total, 49 SCOUT teams participated. Of those 49, 40 were teams of middle school students; of those, four were teams from three of the ITEST middle schools (one PVUSD and two from MPUSD).

Since not all of the MPUSD middle schools had vehicles ready for the regional contest, Jill and the extending learning director arranged another, culminating event where the students could showcase their vehicles and receive recognition. The "MPUSD ROVER Night" was hosted by MAOS at Monterey High School on May 26th. Approximately 30 students from four middle schools along with their teachers, ASA site coordinators, and parents attended. The students had the opportunity to participate in a mini-competition and received certificates.

***What Worked***

The existing and newly-formed partnerships within the Monterey area were a tremendous asset in implementing, supporting, and strengthening the region's ROV education and career pathway. MAOS in particular will be a valuable resource and source of student mentors as the program continues into Year 2.

While mandating participation from her middle schools was not the most ideal approach to teacher recruitment, the MPUSD extending learning coordinator did use the MATE ITEST grant to leverage a district grant to cover teacher stipends for workshop participation and ROV project implementation.

Due to the response generated by Jill's presentation at the MPC president's meeting, MPC's Tech Prep program funded a professional development workshop for high school teachers. Four teachers from area schools took part, helping to build regional capacity and increase the number of high schools offering ROV activities.

To help manage the potential large influx of SCOUT class teams, schools were encouraged to hold their own internal "run-offs," with the top winning team(s) moving on to participate in the regional contest. However, since only four teams had vehicles ready to compete by April, only one school needed to use an internal selection process.

***What Didn't Work and Lessons Learned***

The Monterey Bay Regional ROV Contest already includes a very large and robust SCOUT class support infrastructure and competition event, which was a mixed blessing. On one hand, professional development, student workshops, and event logistics are established and there is an existing pool of volunteer and judges to support the program. On the other hand, adding new teachers and student teams to already-packed workshop and competition rosters had the potential to greatly impact the quality and delivery of the program.

Jill and Kim's idea was to create a slightly different model for the ITEST schools that would not impact the current support offerings and that centered on providing technical support and mentoring via visits to afterschool classrooms. One flaw of this approach that slowly became evident is the fact that the region's pool of volunteers is already taxed by the existing support offerings, which resulted in Matt, Jeremy, and Jill providing the bulk of the technical support.

This, in turn, resulted in schools not receiving all of the support that they needed and in a timely manner.

To address this, Jill plans to identify new sources of volunteers and recruit them earlier in the year. One potential source is the service learning program at CSUMB. Jill has already connected with the program and they are interested in sharing the opportunity with their students. The MPC Vice President of Student Services has offered to help recruit underrepresented students at the college. Jill will offer volunteer training sessions in the fall, then pair the volunteers with a school that they will visit on a weekly basis during the spring afterschool course.

Since the professional development workshop was held in the fall but the program was not implemented in the schools until the spring, many of the teachers commented that they "forgot" what they learned. Jill will move the professional development workshop to January to address this. Further, it was clear that the schools that sent a teacher or a teacher and an ASA site coordinator were more successful than schools that sent an ASA coordinator only. Next year, Jill will require all schools to send at least one teacher.

As expected, one area where the teachers (and their students) needed a great deal of help and technical support was in soldering and wiring their ROV control boxes. Pairing volunteers with schools from the start should help with this, but Jill is also considering offering additional wiring workshops at MPC.

A miscommunication with one of the teams that did compete in the regional event resulted in the students creating a poster display on-the-spot. The coordinators will address this with improved dialogue and planning between themselves as well as amongst themselves and the ITEST teams.

While the grant proposal called for recruiting new teachers in Grant Year 2, Jill will sacrifice quantity for quality and continue to work with and support Year 1 teachers, provided that they need it. Otherwise, her concern is that the program will not be sustained in these schools.

For Jill, balancing the duties as PI, the regional ITEST lead, and the regional event coordinator was a challenge; all roles come with considerable responsibilities and time commitments. In Year 2, some of the regional competition coordinating duties will be shifted to Matt in an attempt to lessen the load.

The professional development workshop application and agenda, sample course outline, and toolkit, are included within the Addenda.

**SOUTHERN CALIFORNIA**

The Southern California Regional ROV Fly-Off is organized by Long Beach City College (LBCC) and supported by the Marine Technology Society-San Diego section and NOAA's Southwest Marine Fisheries Science Center. Teledyne Impulse, and Teledyne RD Instruments, a marine connector and instrumentation company, respectively, also support the event.

Scott Fraser, Chair of LBCC's Electrical Technology Department, is the regional coordinator and the lead on the region's ITEST grant. Marty Alvarado and Saren Rem, from the LBCC grant's office, oversee the financial aspects of the grant, and contribute to the annual reporting of ITEST activities.

Regional implementation began last fall. Scott was required to obtain LBCC board approval before making contact with local schools. Once the board approved the work, he was connected with Sam Platis, the Long Beach Unified School District's (LBUSD) superintendent of middle school instruction. The process of LBUSD board approval complete, Sam worked with Scott to select four middle schools that served large populations of the target audience. The schools then

selected several science teachers, who in turn recruited students. A fifth school from Inglewood Unified School District signed on as a result of a former student who is now enrolled in Scott's program. This private middle school academy serves a reported 90% African American and 10% Hispanic student population. The school has a science and technology program, so the ROV project was a perfect fit.

Professional development for these teachers was delivered through a series of Saturday workshops. In addition to hands-on training in ROV design and building, the teachers also received career information presented by LBCC instructors as well as two LBCC students who had participated in ROV-related internships through the MATE Center's technical internship program.

From the beginning, Scott paired one of his community college students with each middle school. These students were enrolled in his program and were also members of the LBCC EXPLORER class ROV team. Scott's students worked side-by-side with the teachers during the workshops. After the training sessions, his students visited the schools at least once a week for 11 weeks from March through May, helping the teachers to implement the project and providing technical support to the teams. For those teams that made it to the regional contest, the college students acted as "escorts," which helped to ease the anxiety of participating in the event for the first time and not knowing what to expect.

The culminating event was the SCOUT class competition, which was held as part of the Southern California Regional ROV Fly-Off on May 8th, 2010. This was the first year that the regional offered a SCOUT class. A total of twelve teams of 4-6 students participated; each of the five ITEST middle schools fielded at least one team. While some experienced technical issues, overall the teams had functioning vehicles – and team spirit! In addition to professionals from the Teledyne companies and NOAA, several LBCC students also served as competition judges and technical support. In this way, the event itself provided the students with additional exposure to examples of ocean technical careers.

***What Worked***

By connecting with the administration and other departments at LBCC, Scott was able to garner campus-wide interest in and support for the program. Instructors from other programs delivered presentations during the workshops, and the campus newspaper covered the competition event. In addition to support for fiscal operations, LBCC's Technology Preparation Program ("Tech Prep") provided Perkins Career Technical Education funds for teacher stipends. The grants office helped to make connections to LBUSD.

Pairing the LBCC students with the schools was a win-win all around. Not only did it help the college students to solidify their own learning, it was also a valuable resume-builder. From a program management standpoint, it was a division of "labor" and accomplished more than trying to have one person service all five schools. The LBCC students served as role models and examples of pathways to follow to postsecondary education and possible careers. Two of the LBCC students were also minorities, which no doubt helped the minority middle school students to connect with them.

Many of the teams had parental involvement. For example, the school from Inglewood had three parents who helped to mentor the team and facilitated opportunities to test the ROV in local swimming pools. Parental involvement is probably one of the reasons that each of the five schools saw the project to completion.

***What Didn't Work and Lessons Learned***

LBCC and LBUSD board approval was a slow process. However, while it was time-consuming, those obstacles no longer exist and Year 2 activities can ramp up much more quickly.

Like Monterey, Southern California is a victim of its own success. With the addition of the SCOUT class, the total number of teams (RANGER+SCOUT) participating in the regional increased from six in 2009 to 20 in 2010; managing this growth is a challenge. However, an option is expanding it to a two-day event. Another option is, like Monterey, to encourage schools to have their own internal "run-offs," with the top winning team(s) moving on to participate in the regional contest.

Having the LBCC students serve as mentors and visit the schools did take them away from their own ROV project. However, even with the challenges that the program imparted to their own team, overall the student themselves felt that benefits of their participation, influence, and impact outweighed the "costs."

Administering the teacher workshop surveys on top of coordinating the grant work proved challenging. Advance planning will make that a non-issue next year.

**PACIFIC NORTHWEST**

The Pacific Northwest (PNW) Regional ROV Challenge is organized and operated by the Marine Technology Society (MTS)-Puget Sound section. Fritz Stahr and Rick Rupan are MTS-Puget Sound members (Fritz is the current section chair) and technical professionals in the School of Oceanography at the University of Washington (UW) in Seattle. They serve as regional co-coordinators and are the leads on the region's ITEST grant. Fritz and Rick hired Kailey Genther, a graduate student in the UW School of Marine Affairs with a background in science education, to oversee recruitment and serve as the main point of administrative contact for the teams. The MTS-Puget Sound section is the fiscal agent for the grant funds.

Regional implementation began last fall. Fritz, Rick, and Kailey created and distributed flyer announcing a one-day professional development workshop to be held in December. The announcement was sent to 21 local school districts that include 95 middle schools. Teachers who responded to the announcement received an application to attend. Twelve teachers submitted applications. All were a good fit and because two of those were from the same school and one was a high school teacher associated with one of the middle schools, all were accepted.

During the workshop, teachers were lead through the design and assembly of a basic ROV from a kit of parts. They took those completed (or mostly completed) ROVs back to their schools with some curriculum materials to use in whatever way best fit within their school's STEM programs. They received information about UW's Oceanography programs, including Seaglider and Argo float autonomous underwater vehicles, as well as examples of ocean STEM-related careers through Fritz and Rick's participation.

Before they left the training session, the teachers had the opportunity to sign up for follow-up visits to their schools by ocean technology professionals. Visits to seven schools started in January and continued through April. Many of the visits were day-long, school-wide or multiple classroom affairs, with presentations delivered by Fritz, Rick, and two members of the MTS-Puget Sound section. Typical class sizes where 20-30 students each and several school visits included presentations to afterschool clubs. The talks presented information about ROVs and other underwater technologies, the ROV competition, and careers in oceanography. Fritz and Rick also brought along examples of commercial underwater technologies, including Seagliders and Argo floats.

The students and teachers attending the school presentations were given flyers about the PNW Regional ROV Challenge and encouraged to build a vehicle to compete. As a result, the students that ended up taking part in the PNW regional were those of the workshop teachers as well as other students from the same schools who were members of afterschool robotics clubs. The students from the afterschool clubs had enlisted the help of their parents as team mentors.

In order to ensure that as many students as possible could compete, a mini-grant application process was created so teams that most needed parts and tools could obtain them through the ITEST program. Fritz and Rick evaluated those applications, then purchased and delivered parts, kits, and tools to the neediest teams. All of the applicants received at least some of what they had requested.

A full-day wiring workshop was held in March, with more than 50 teachers, students, and parents attending. (Many of the parents appreciated learning how to use a soldering iron along with their children!) A half-day meeting that presented specific information and answered questions about the regional competition was also offered to participating teams. Two of the teams requested specific help with wiring and buoyancy; Rick invited them to UW for one-on-one mentoring. Several teams had difficulty finding a pool to practice in, so Rick and Fritz opened up the test tank at the School of Oceanography. During those Saturday pool practice sessions, Rick and Fritz helped teams troubleshoot technical issues.

The grand finale was a SCOUT class competition held as part of the PNW Regional ROV Challenge, which took place on May 8th, 2010. While the PNW regional had offered a SCOUT class event in years past, it had been poorly attended (1-3 teams). As a result of the ITEST activities, 24 teams registered this year; 22 of those teams ultimately participated. All but two of the SCOUT class teams were from the teachers (or their schools) who had taken part in the professional development workshop. Of the 11 middle school teachers who attended the workshop, only two did not participate in the competition event, but indicated that they would next year. One of those two withdrew her teams a week in advance of the event; clearly she and her students were close to being ready.

***What Worked***

The existing intimate partnership with the MTS-Puget Sound section provided Fritz and Rick with a pool of technical professionals willing to donate their time and expertise to school visits, workshop support, and the competition event. Similarly, the relationship to UW lead to a wealth of support for the grant activities, including access to undergraduate and graduate students to assist with the work and facilities for the professional development workshop and practice sessions for teams without access to a swimming pool. The Director of the School of Oceanography's recognition and support of the program provided Fritz and Rick with the professional acknowledgment that is important for their own careers. Having Kailey on board to lead recruitment efforts allowed Fritz and Rick to focus on providing technical content and support to the teams.

The mini-grant application process ensured that only those teams that truly needed resources received them, while the school visits helped recruit additional teams and broaden the impact of the grant funds. The visits exposed more than 1,000 students to ocean applications of STEM, underwater technologies, and technical career opportunities.

Parents support much of the current afterschool activity in public schools. In the case of the ROV program, this support was critical as some of the participating teachers lacked the technical background (and the time) to effectively mentor their students. The parents were able to pick up where the teachers' knowledge and skills left off, which clearly played a key role in many team following the project through to completion.

***What Didn't Work and Lessons Learned***

Like Monterey and Southern California one of the challenges that comes with success is managing the growth of the competition. The PNW regional tripled in size from 2009 to 2010. Fortunately, the venue (an Olympic-sized pool with a separate high-dive pool in Federal Way, Washington) is not the limiting factor, nor is recruiting enough volunteer judges. What may help is increased "crowd control" and additional volunteer training. The MATE Center is working to provide resources for the latter. Wes Thompson, an engineer at UW's Applied Physics Lab, will join the coordinating team to focus specifically on the organization and delivery of competition

event-day information, which should help to cut down on any miscommunications and their potential resulting team protests.

In spite of the widespread recruiting efforts, the PNW ITEST activities did not engage a significant number of minority or low-income students. Rick, himself of minority background, conducted visits to three schools who serve large percentages of these populations, but none of these schools developed student teams to build ROVs and participate in the competition. Lack of parental involvement could be a contributing factor. In Year 2, the coordinators plan to supplement parental support with mentors from industry that can be matched with individual teachers, hopefully overcoming whatever barriers to student involvement exist.

The professional development workshop announcement and the mini-grant application as included within the Addenda.

**NEW ENGLAND**

The New England Regional ROV Contest is organized by the Marine Technology Society (MTS)-New England section. The contest is supported by both individual and company members of the MTS-New England section, the Massachusetts Maritime Academy, the University of Massachusetts-Dartmouth (UMass-Dartmouth), and Bristol Community College.

BCC is the lead organization on the MATE ITEST grant activities. Meghan Abella-Bowen, a staff member in the Mathematics, Science, and Engineering division at BCC, is the ITEST lead. Meghan is also the director of BCC's Southeastern Massachusetts Achievement & Retention in Technology (SMART) Program, which is funded through NSF-Advanced Technological Education. Anthony Ucci, a BCC faculty member and SMART Project PI, assisted with organizational and fiscal aspects of the New England ITEST grant as well as teacher recruiting.

Chris Jakubiak, a technical professional at UMass-Dartmouth's School of Marine and Science Technology (MAST) and current chair of the MTS-New England section, provided technical assistance during the professional development workshops and SCOUT class competition event. Sue Mauretti-Black, a former MATE Summer Institute participant and current high school engineering and technology teacher, served as a teacher trainer and local resource.

In addition to the MTS-New England section, Lockheed Martin Sippican provided personnel and supplemental financial resources to support teacher professional development.

Regional implementation began last fall. Teachers were recruited through several venues. For the teacher professional development workshops, a list of middle school science and technology department chairs and teachers was compiled for the cities of Fall River, New Bedford, Taunton, and Attleboro. Organizations such as Upward Bound (www2.ed.gov/programs/trioupbound/index.html) and Citizen Schools (www.citizenschools.org) were asked to identify additional teachers who might be interested in participating.

The teachers on the list received e-mails and flyers (and a follow-up reminder) announcing a January professional development workshop at BCC. The department chairs also received e-mails about the workshop that included an offer to present information about the program to teachers at a department meeting.

Information was sent to the superintendents and middle school principals of the New Bedford and Fall River school districts. The workshop was also advertised in BCC's Career and Vocational Technology Education (formerly Tech Prep) newsletter. Later, participation in the workshop was promoted to the staff of local youth programs, including the Boys and Girls Clubs of Fall River, New Bedford, and Taunton; YMCAs; and the Boy and Girl Scouts.

As a result of the fall teacher recruitment efforts, seven formal and informal middle school educators attended the January professional development workshop. In addition to hands-on training in engineering and fabricating an ROV, the workshop provided teachers with techniques for integrating the ROV project into their classroom and information about engineering and technology programs at BCC to pass along to their students.

A student outreach program was implemented in parallel with the fall's teacher recruitment. Prior to the ITEST grant, the Citizen School program had contacted Meghan about becoming involved in the ROV program. Citizen School is an afterschool program for low-income students in New Bedford. Middle school students participating in the program can choose between a variety of apprenticeship activities to complete during the semester. Under Meghan's guidance, BCC engineering students developed and delivered the curriculum for a 10-week ROV apprenticeship to a total of 30 middle school students at two schools. The apprentice culminated in a mini-competition held in January of 2010. For their efforts, the BCC students received community service volunteer hours.

The BCC students' involvement continued into the spring semester. In February, students from the YMCA and the Boys and Girls Clubs were invited to participant in a basic ROV design and building workshop. The BCC students, as well as professionals from Lockheed Martin Sippican, guided the students through the process. Twenty-two middle school students took part.

As a result of this student workshop, the Boys and Girls Club of Fall River asked Meghan to offer the 10-week curriculum program to its students. Meghan recruited new BCC engineering students to deliver the content and provide mentoring.

The teacher workshop and fall and spring student programs culminated in a SCOUT class event held on June 12th, 2010. Four teams representing a total of 13 students participated, three of which came from the Fall River Boys and Girls Club. The event was held separately from the existing New England Regional ROV Contest.

***What Worked***

The existing partnership with the Citizen School program allowed the student program to ramp up quickly. The new partnership developed with the Boys and Girls Club has the potential to blossom into a long-term, mutually beneficial relationship. The support from the MTS-New England section, UMass Dartmouth, and Lockheed Martin Sippican was invaluable in allowing the existing regional ROV activities to expand to middle schools.

Like Southern California, enlisting the help of the community college students to deliver content and hands-on experiences was a win-win all around. See the Southern California section above details the outcomes and benefits.

Similarly, having a teacher like Sue Mauretti-Black who has experienced many of the same challenges and frustrations is an incredible asset. Other teachers can relate well and, by her example, gain confidence to carry out the project.

The SCOUT class competition was particularly successful. Holding the SCOUT class competition separately from the RANGER New England regional kept both events manageable. Interacting with the BCC ROV students made up for the lost opportunity to make connections and build upon their learning by interacting with the RANGER teams.

***What Didn't Work and Lessons Learned***

Despite the extensive recruiting efforts, there was a low turnout for the teacher professional development workshop. In an effort to determine why, Meghan spoke to a number of middle school teachers who said that while they were interested in the program, they felt that they could not integrate ROVs into their classroom instruction. Teachers feel pressure to teach directly to the state mandated curriculum frameworks and feel that they do not have enough time to cover

all that is currently expected. The idea of additional activity is overwhelming. These teachers do not have the time or energy to determine how to tie ROV activities to their existing curriculum.

Meghan plans to arrange meetings with school superintendents, principals, and department chairs earlier in the year in an effort to generate interest and support for teacher participation. Integrating the ROV professional development workshops into already-scheduled teacher pre-service offerings is another strategy. In addition, the middle school curriculum being developed under this objective should help the teachers to see how the ROV project can be used to engage and instruct students in the practical applications of STEM.

While the Citizen School apprenticeship program was successful overall, a breakdown in communication resulted in only one team taking part in the January mini-competition. Next year Meghan will make sure that all teams receive the necessary information in a timely manner. However, communication to teams taking part in the June SCOUT class competition event was not an issue, as evidenced by the number of students participating.

Examples of modules from the 10-week curriculum program are included within the Addenda.

**SUMMARY OF DEMOGRAPHIC AND IMPACT INFORMATION**

Demographic data collected from three of the regions show that at least two were reaching minorities: 90% of the middle school students from the MPUSD ASA were reported as non-white, while 50% of the students from the Boys and Girls Club of Fall River (Massachusetts) were categorized as “minority.” In terms of gender, MPUSD’s ASA reported that 50% of their participants were female. The Citizen’s Program reported that 100% of the students from Keith Middle School in New Bedford, Massachusetts had free/reduced lunch status, as did 92% of the students in the Boys and Girls Club of Fall River.

One hundred percent of the teachers responding to post-professional development workshop surveys stated that they felt more confident facilitating STEM learning experiences as a result of the training; 89% felt more committed to participating in the competition.

Post-competition student survey found that 97% of the respondents felt that they knew more about marine-related STEM careers as a result of their participation; 71% stated that their ROV project made them more interested in a marine career. Seventy-five percent of the students indicated that their ROV project made them want to learn more about ocean STEM.

The results of parent surveys were equally as encouraging. Of the survey respondents, 95% stated that building an ROV made their child more interested in STEM; 81% indicated that participation in the program changed how they envisioned their child’s future, making it easier to picture their child in a STEM career. Seventy percent of parents reported that their children were better able to work with others due to their involvement in the ROV project; 70% also found that their child’s self-confidence improved. Seventy-two percent of the parents reported that building an ROV contributed to improving their child’s grades in science; 55% reported improved grades in math; 61% reported improved grades in computer science; and 76% reported improved grades in engineering/robotics.

Results of pre- and post- teacher workshop surveys, post-competition student surveys, and parent surveys are presented and discussed in greater detail within the evaluation report (see Addenda).

**SUMMARY OF MATE CENTER SUPPORT**

In addition to financial resources via the grant funds, the MATE Center provided each region with a pdf of its existing curriculum materials; samples of workshop agendas, competition scoring templates; and guidance and feedback, as needed, via individual phone calls, conference calls, webinars, and e-mails on both a scheduled and an as-needed basis. In addition, the Center worked with other personnel, such as the grants office at Long Beach City College, to hammer out the regional specifics and ensure that the grant would and was running smoothly. Based on the information provided in the evaluation report, the regional coordinators were satisfied with the level of support that the MATE Center provided.

While the pdf of existing curriculum materials was a good starting point, we recognized that the materials were not "complete" nor were they designed specifically to meet the needs of the target audience. We are confident that the curriculum product developed under this project and available this fall will be a significant improvement and valuable resource for both the regions carrying out ITEST activities in Year 2 and the teachers and students that they will serve.

Several of the regional network coordinators as well as teachers (ITEST and "non-ITEST" teachers) have stated that a video documenting students as they progress through engineering and construction would be extremely helpful in both selling the ROV program to administrators providing support to new teams. We will work towards producing such a resource during Grant Year 2. Further, ROVER, with its collection of videos, photos, resources, and links to outside help, will provide much of the needed support.

**● Develop four curriculum modules to support afterschool learning for middle school students.**

A pdf file of MATE's *current* collection of instructional materials, including PowerPoint presentations, activities that demonstrate specific concepts, design and fabrication tips, step-by-step instructions for building specific components, and competition specifications and mission tasks, among others, was created and disseminated to the four regionals implementing ITEST activities in Year 1. From there, it was shared via e-mail or DVD with the teachers who participated in each regions' professional development workshops in an effort to both support them in implementing the ROV project with their students and gather qualitative feedback about its usefulness.

The collection of materials was also shared with the members of the Curriculum and Cultural Advisory Committee during a meeting held in March 2010 (see **Advisory Committee** below for more information). Feedback from the committee was positive. Noted areas of improvement included ensuring that the materials were aligned with middle school content standards, modular, contained pointers for securing administrator buy-in, and provided examples of how to set up an ROV workspace, among others. These were all comments that we anticipated and recognize need to be addressed.

The most significant achievement toward the curriculum objective is the collaboration that MATE developed with the Shedd Aquarium. The aquarium is the lead coordinator of the MATE Shedd Midwest Regional ROV Competition. As part of its efforts to support regional teams, the Shedd had embarked on creating a STEM curriculum for middle and high school audiences. The curriculum focuses on ROVs as a way to engage students and deliver the information. Shedd curriculum development specialist and program managers had begun testing the draft curriculum at its teacher professional development workshops.

The MATE Center and the Shedd Aquarium are now pooling information and resources to co-develop the ITEST project's curriculum modules. DeDee Ludwig, a curriculum development specialist at the Shedd who is also the primary point of contact for the regional contest, is taking the lead. DeDee attended the March advisory committee meeting where she was able to gather information and feedback first-hand. She is also planning to attend the entry-level ITEST Summer Institute to further understand and appreciate the needs and challenges of our middle

school audience. In addition, DeDee will be connected with the project's content experts (Joe Slovacek, Cerro Coso Community College, mathematics; Scott Fraser, Long Beach City College, electronics; Jeremy Hertzberg, Monterey Peninsula College, computer science) in order to collect topic-specific input and content review.

The schedule for development of the curriculum modules is on target. The proposed plan was to disseminate the curriculum to the regionals continuing or implementing ITEST project activities in Year 2; a draft of the curriculum will be delivered in early November 2010 and distributed to all members of the regional competition network. A formal mechanism (online or paper survey) will be generated to collect feedback from both the regional coordinators delivering the curriculum and the teachers using it. This feedback will inform "draft 2," which will then be tested and improved based on feedback from Year 3 regionals and teachers. To ensure the best quality product for widespread dissemination, we will delay posting the modules on the ROVER website until the spring of 2011, after feedback from the curriculum's first "round" of use is collected and incorporated.

● **Offer an entry-level MATE Summer Institute for Professional Development.**

The first annual ITEST Summer Institute, *ROVER: ROV Education and Resources for the Classroom*, is scheduled to take place July 12 – 18, 2010 at Monterey Peninsula College. The overarching goal of the Summer Institute is to provide additional instruction to regional ITEST teachers and to establish all participants as knowledgeable regional resources.

Specifically, participants will spend the week solidifying current and acquiring new knowledge and skills and seeing examples of how they can use ROVs to instruct students in STEM subjects. They will also tour the Monterey Bay Aquarium, with its ROV exhibit a focal point of the tour, and the Monterey Bay Aquarium Research Institute (MBARI) to see first-hand ROVs and other ocean technologies and learn how they are used in research and exploration. Visiting MBARI as well as presentations about OceanCareers.com and the *Exploring Ocean Careers* course will provide them with examples of ocean STEM career opportunities – information that they can then pass on to their students. For the PIs/Co-PIs, querying participants about existing career resources and their specific needs will help to inform work on Objective 2.

As proposed, recruitment focused on the four regions implementing ITEST activities in Year 1. Regional coordinators notified their ITEST participants of the opportunity to attend the MATE Summer Institute during their professional development workshops. Post-workshop, regional ITEST teachers sent a printed copy and e-mailed a two-page flyer describing the workshop, including the goals of the session.

In the spring, a formal e-mail invitation to apply was then sent by MATE to each participant. The e-mail included the two-page flier as well as an application. The application was set up to be received via online submittal, fax, e-mail, or hard copy.

Eight middle school teachers from the Year 1 regional ITEST areas applied. Four from the Monterey region, two from the Southern California region, one from the New England region, and one from the Pacific Northwest. Additional recruitment strategies of personal phone calls and e-mails from the Summer Institute coordinator assisted with some of these applicants. In an effort to meet our target number of 20, the institute was then opened to middle school teachers from other regionals and, later, promoted to the entire MATE network of teacher contacts. As a result, we received six additional applications.

Recruitment of teachers from ITEST regions proved difficult, despite the offer of additional instruction and resources as well as funds to support travel, housing, and meals. Currently, 14 teachers are scheduled to attend. Despite receiving eight applications, only three of the 14 teachers are from ITEST regions. The following are examples of the reasons provided by those who dropped or from the start were unable to attend:

*The students at our school loved the program are already excited about next year's competition. Again, thank you for your patience. We are having a big turnover of science teachers at our school this year so I don't think we will send someone this summer.*

*Unfortunately I will be out of town on vacation in July when the workshop is being offered so I'll have to miss it.*

*[Originally] I was excited to say "yes". I just recently was forwarded the application to fill out and realized it was not just Monday - Friday but through Sunday. I have a wedding that I must attend in Ventura on the 17th.*

We recognize that we need to start promotion and recruitment to Year 2 ITEST regions earlier in the school year (teachers informally polled said that by February many had already planned their summer activities, including family vacations and attending other professional development workshops). The 2011 application will be posted and circulated by the start of the New Year.

Organizations such as the National Middle School Association (www.nmsa.org) also provided some insights. NMSA surveys of 7,000 of its 30,000 members indicate that in most cases school principals or administrators are the decision makers for attending professional development workshops and incorporating material into the middle school classroom. Ensuring the buy-in of the principal and/or administrative staff may be the catalyst to increase the number of participants. Given this information, our Year 2 approach will include more direct contact with the administrative staff of our target audience.

See the Addenda for the application, the list of participants, and agenda.

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***Objective 2:*** **Increase ocean STEM career awareness and present trajectories to those careers for middle and high school audiences.**

**● Adapt and enhance OceanCareers.com and *Exploring Ocean Careers* for grades 6-12.**

Although *OceanCareers.com* (www.oceancareers.com) and the *Exploring Ocean Careers* online course have been extensively tested with college and upper level high school students, they are currently untested and unproven with middle school audiences. Much of this first year has been spent researching existing middle school career resources and meeting with the project's advisors as well as middle school teachers in an effort to understand the needs and requirements of this target audience.

The Curriculum and Cultural Advisory Committee members provided excellent guidance and advice on questions that we should address for middle school students as well as their parents. These questions include: Will my family accept this? Will I be able to balance having a family of my own someday with this career choice? Will I be able to support my family? I want to live the good life: will an ocean career give me that?

Results of parent post-competition surveys, 80% of the parents indicated that they believe they have at least some influence on their child's choice of careers The committee members strongly advised us to make sure that there is complementary career guidance and information for parents. They also emphasized the importance of making the connection between the ROV activities and the job skills that people need to be successful. These job skills include both the STEM knowledge and abilities and Secretary's Commission on Achieving Necessary Skills (SCANS) skills, such as teamwork. The advisors also recommended that we leverage career information requirements that are found in the national educational standards.

In one focus group of middle school teachers, many felt the Internet was one of their main sources of career information. Since discussions of career opportunities are part of most state standards, many students are directed to the Internet to complete assignments or gather background information for discussions and presentations. Career resources that middle school teachers use include the AVID (Advancement Via Individual Determination) Program, Prism, The Great American Teach-In, and Choices among many others. The teachers wanted curriculum that directly tied to careers and career pathways so they can better establish the relevance of their educational activities to future career opportunities. They also like having their students exposed to working professionals and students at higher levels of education so that career pathways are tangible.

This objective is several months behind schedule due to the fact that the staff person who taught the *Exploring Ocean Careers* had to leave the Center for family reasons. We have reallocated the work and will start simplifying and shortening MATE's existing career information based upon focus group and advisory committee recommendations this fall.

Information about the course and website will be disseminated to the target audience (teachers, students, and parents) via the fall/spring regional teacher professional development workshops and the follow-up student workshops taking place next spring.

● **Provide the *Guide to Marine Science and Technology Programs in Higher Education* to middle and high schools.**

We are currently summarizing the list of 282 middle and high schools (including mailing addresses) that participated in its 2010 international and regional competitions. Once complete, the Marine Technology Society (MTS) will send each school one hard copy of the *Guide to Marine Science and Technology Programs in Higher Education*. Developed and produced by the MATE Center in collaboration with MTS, the guide includes detailed information about more than 1,200 programs within the U.S. The copies and associated shipping costs will be covered in-kind by MTS.

The guides will be sent prior to the start of the new school year, keeping the project on schedule with this activity.

● **Couple efforts with postsecondary academic institutions.**

Each of the four regions implementing ITEST activities in Year 1 connected with (if they weren't already) postsecondary academic institutions within their areas. As these regions carried out teacher professional development, student workshops, and SCOUT contest events, they worked in collaboration with these institutions to combine career information and dissemination efforts.

**MONTEREY**

The MATE Center is based at Monterey Peninsula College, providing Jill Zande, the PI and regional coordinator, with easy access to STEM-related program information, recruiting materials, and career guidance tools. Examples of these included engineering, computer science, and marine science and technology program brochures, PowerPoint slides, and "How to Get to College" flyers for grades 6-12 produced by the California State University system. These resources were shared with teachers during professional development workshops and with students during the ROV competition events.

What is needed in Monterey is a "map" of the educational pathway that uses the regional ROV program to lead students from middle schools to high schools to MPC and other, local postsecondary institutions. Work towards this product will begin this fall.

**SOUTHERN CALIFORNIA**

The Long Beach City College's (LBCC) Electrical Technology Department Chair, Scott Fraser, is the lead on the Southern California ITEST grant. As described in detail under Objective 1 above, Scott paired students from his LBCC program (who also happen to be members of his EXPLORER class ROV team) with the participating schools. This not only provided specific examples of LBCC's "student products," it also provided the teachers and students with role models – the potential that these students can reach if they stay engaged and choose to purse a STEM education and career.

**PACIFIC NORTHWEST**

Fritz Stahr and Rick Rupan, the co-leads of the Pacific Northwest's ITEST grant, are both technical professionals at the University of Washington (UW). The individual who Fritz and Rick hired to oversee outreach to schools, is a graduate student in UW's School of Marine Affairs. The university administration supports the grant activities by providing access to its facilities and other resources; for example, the teacher and student workshops took place on the UW campus. All of these factors allowed teachers, students, and parents to make quick connections to postsecondary opportunities at the university and, beyond that, to potential careers. Presentations at schools by Marine Technology Society-Puget Sound section members also provided participants exposure to examples of ocean STEM careers.

**NEW ENGLAND**

As with the three other regions implementing ITEST activities in Year 1, the lead on New England grant is also a postsecondary institution – Bristol Community College. Meghan Abella-Bowen, the ITEST grant's lead coordinator, is a staff member in the Mathematics, Science, and Engineering division at BCC. As described in detail in Objective 1 above, Meghan recruited BCC engineering students (several of whom were also on BCC's EXPLORER class team) to deliver content and instruction to the participating schools. The benefits of this are the same as described above for the Southern California region. In addition, because BCC has an existing relationship with the University of Massachusetts-Dartmouth (and a technical professional there serves as the New England regional contest coordinator), Meghan was also able to share information about and make the connection from BCC to bachelor's degree programs.

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***Objective 3:*** **Build a cyberlearning center to a) foster collaboration and increase communication among students, educators, parents, and working professionals; and b) improve access to STEM instructional resources.**

**● Develop, build, and launch the ROV Education and Resources (ROVER) cyberlearning center.**

The ROVER (ROV Education and Resources) website began to take shape in September 2009 and currently resides at www.rover.itest.us/main. The website is built on the latest generation of content management technology called Joomla. Joomla offers ROVER administrators some important advantages, and thus far has proven to be the correct technology because:

- Joomla handles the look and feel after initial set-up so that site administrators can then focus their efforts on content;
- Joomla has thousands of extensions available for expanding its capability, some of which are being used with ROVER to include PHPBB (a discussion board) and Stalker (provides links to social media outlets), among others; and
- Joomla's framework allows building custom, special-purpose extensions.

The philosophy behind the ROVER website is to make it a portal in the truest sense of the word. In that respect, ROVER will point users to the information they are looking for, regardless of whether or not that information is warehoused on the ROVER site.

ROVER can be thought of as a system containing four major components. The first component (Component 1) consists of the information and resources gathered and developed by the MATE Center and its ITEST partners. For example, ROVER users will have access to existing PowerPoints, videos, design and building resources (such as camera waterproofing instructions, wiring diagrams, etc.), and instructional materials, among other MATE products.

The second major component (Component 2) of ROVER is the link to additional ROV resources. Accomplishing this is manpower intensive but may have the greatest impact on the value of ROVER in terms of attracting new stakeholders and providing them the information they are looking for – or directing them to information that they may not yet know that they need.

Another component (Component 3) is social media. The primary social media outlets that ROVER is connected with are Twitter and Facebook. These outlets will be utilized to "push" information to users in a manner in which they are accustomed. These social media tools have the added benefit of promoting and increasing the project's exposure. In addition, photos and videos from ITEST activities and competition events are warehoused on Flickr.com and Youtube.com. Flicker and Youtube are quasi-social media sites in their own rights and further expand the project's reach. In addition to a MATE presence existing on these very heavily used sites/services, there is a link to these MATE accounts on each page of ROVER.

The final component (Component 4) of the ROVER system is its role as the information and management location for the MATE ROV competition network. This component will improve upon the existing competition administration system, allowing the international and regional competition coordinators to more effectively manage team registrations. Student team members, teachers, judges, and sponsors will visit ROVER to access all of the information, including mission tasks, design and building specifications, travel and logistics, regional contest information, archives of previous competitions, and more.

ROVER is up and running. Joomla, PHPBB, and other components have been installed. A template was chosen and a consistent "look and feel" has been established throughout the site.

Current progress towards the objectives of Components 1, 2, and 3 include:

- ROVER links to current ROV competition information (at present hosted on the MATE website)
- MATE-created information and resources are posted
- The discussion board is installed
- There are hundreds of links to ROV and other underwater technology-related multimedia
- Other related resources have been collected and categorized
- Links to MATE social media have been established
    - Twitter was used during the 2010 ROV competition season to update competitors with important competition information
    - A MATE Facebook presence has been established
    - The MATE ROV Competition Flickr account has been established and populated with about 100 photos from regional competitions. Many more photos, including those from the international competitions, are on the way.
        - A public ROV Competitions group has been created to allow competitors, parents, and other stakeholders to link their photos
    - The MATE YouTube account has been established and populated with 22 videos from 2010 competitions. As of June 30, 2010, these videos have been viewed 596 times.
    - The links to MATE's social media outlets are part of our e-mail signatures.

ROVER will launch in September 2010, to coincide with the start of a new school year, with Components 1, 2, and 3 fully functioning. Prior to that launch:

- A linkage application will be written that allows MATE AlumniWeb (www.marinetech.org/alumni/users) to sign into ROVER using their AlumniWeb credentials. (AlumniWeb was created by the MATE Center to collect and track information about program participants.) This will allow past participants to log into ROVER without needing to create a separate account.
- A custom application will also be created that will force users (new and existing) to answer a few questions as they initially log in. This type of survey feature can and will be invoked periodically to assist in collecting important data about ROVER users.

As ROVER is made public, each of MATE's social media accounts will be updated to contain direct links to the ROVER site. In addition, we will launch a publicity campaign to educate past ROV competition participants about ROVER. This campaign will include a strong call to action to induce past participants to link up with the MATE Center's social media accounts.

ROVER's launch is about one month behind schedule. It was delayed in order to work out the mechanics associated with linking the AlumniWeb and ROVER user systems.

Once ROVER is made public, it will continue to evolve and expand as additional information and resources are collected and, more importantly, as the website's users suggest additions and improvements. Work on Component 4 (preparing ROVER as the management and information hub for the 2011 competition season and beyond) will also continue, with a target completion date of December 2010 (in time for the opening of registration for the 2011 competition season).

What is sure to be a powerful (and popular) feature of ROVER is its proposed "Mentor Hotline," a geo-referenced directory of working professionals and the "services" (design reviews, tours of facilities) that they offer. Recruitment of mentors to populate the hotline is underway; work on the mechanics of the feature, including a mechanism for tracking its use and following up on connections made, will begin in earnest this fall.

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***Objective 4:*** **Evaluate and track project participants to determine the impact on a) students' STEM knowledge, skill development, and inclination to pursue STEM education and careers; and b) teachers' confidence in facilitating STEM learning experiences and delivering career information.**

The independent evaluation of this project is being conducted by Kyra Kester, PhD, and Candiya Mann, MPA, of Washington State University's Social and Economic Sciences Research Center. The preliminary evaluation findings indicate that the MATE Center's ITEST project is achieving the expected outcomes. The project strategies that were implemented in the first year of the grant and related research questions are reviewed below.

**Project Strategy 1: Provide Professional Development**

- Increased confidence facilitating STEM learning experiences: In the post-workshop surveys (N=30), all of the respondents (100%) stated that they felt more confident
- Strengthened commitment to participate in the program: As a result of the training, 89% of the workshop attendees indicated that they felt more committed to participating in the competition.

**Project Strategy 2: Support the Development of the SCOUT (Entry Level) ROV Class**

- Increased Awareness of STEM Careers: After building their ROV, 97% of the students surveyed (N=98) indicated that they knew more about careers in marine STEM.
- Increased Interest in STEM Careers: Seventy-one percent of the students stated that their ROV project made them more interested in a marine career.

- Increased Interest in STEM: Three quarters of the students (75%) indicated that their ROV project made them want to learn more about ocean STEM. Ninety-five percent of the parents surveyed (N=80) stated that building an ROV made their child more interested in STEM.
- Increased STEM Knowledge & Skills: Parents reported that building an ROV contributed to improving their children's grades in science (72%), math (55%), computers (61%), and engineering/robotics (76%).
- Increased SCANS Skills: All of the teachers/mentors surveyed observed increases in their students' skills in team building, problem solving, and/or critical thinking. Seventy percent of parents reported that their children were better able to work with others due to their involvement in the ROV project; 70% indicated that their child's self confidence improved, and 28% marked that their child was better organized.
- Increased Parental Support of Their Children's Interest in STEM: Eighty-one percent of the parents indicated that participation in the ROV program changed how they envisioned their child's future, making it easier to picture their child with a STEM career.

The remaining project strategies will be evaluated in future grant years as they are implemented.

**Preliminary Findings by Gender and Ethnicity**

Overall, positive results were found regardless of gender or ethnicity: increased awareness of and interest in STEM careers, increased interest in studying STEM topics, and increased STEM knowledge. In general, the ROV program appeared to generate stronger gains in the boys than the girls and in the white students than the minority students. A few findings ran counter to this trend. Female students were more likely than male students to indicate that they wanted to learn more about undersea volcanoes (Male: 65%; Female: 69%). Minority students showed greater gains than the white students in their desire to take courses in math (White: 37%; Minority: 41%) and engineering (White: 9%; Minority: 29%).

The complete evaluation report, including the evaluation instruments, can be found within the Addenda. The project's evaluation plan can also be found within the Addenda.

## REGIONAL COORDINATORS' AND ADVISORY COMMITTEE MEETINGS

**Regional Coordinators Meeting**

After surveying participants for their preferred date and location, the 2009 MATE ROV competition regional coordinators' meeting took place on October 26th in parallel with the annual MTS/Institute for Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) Oceans conference and exhibition in Biloxi, Mississippi. Holding the meeting in conjunction with the Oceans conference provided participants with the added bonus of attending the conference's technical sessions and visiting the exhibit hall. In particular, it allowed those who had never attended before to get a better sense of the breadth and depth of the ocean community and the latest developments in ocean science, engineering, technology, and government affairs.

Twenty coordinators representing 16 regional events, including three new regionals scheduled to take place for the first time in 2010, attended. The meeting included a debrief of the 2009 competition season, lessons learned to apply to "next year," and sharing plans for 2010. In particular, emphasis was placed on consistency across the regional network, from the props used on the underwater missions to judges' and volunteer preparation. Several regionals (Florida, the Big Island, and Newfoundland and Labrador) were asked in advance to share their best practices for involving the local community and providing professional development for both teachers and students.

Details of MATE's ITEST grant were presented, including the resources for and expectations of the regionals as they carry out this work. Candiya Mann, the MATE and ITEST project's evaluator, talked about the role of evaluation in shaping and refining the grant activities as well as

the types of survey instruments that she will use. The four regionals implementing ITEST grant activities in Year 1 shared their vision for implementation and were given the opportunity to ask questions of the ITEST PIs as well as gather ideas and feedback from the other members of the regional competition network. Strategies for engaging diverse learners (e.g. involve mentors of similar ethnicities and backgrounds as demonstrate how ocean careers do not preclude family obligations) and parents (e.g. create and translate an overview of the ROV project and invitations to the competition events to Spanish) were also discussed.

This was the kick-off meeting for ITEST grant activities, and it was on schedule. There was one significant lesson learned. Due to both conference space and participants' scheduling issues, the meeting was less than one day. More time to present and discuss topics is absolutely needed. Future meetings will be at least one full day, possibly one-and-one-half days.

Rather than at the international competition, the Year 2 regional coordinators' meeting will again be held in conjunction with the annual Oceans conference, which is taking place in September 2010 in Seattle, Washington. Coordinators prefer the timing of a fall meeting as that allows them to get information and feedback to help shape their upcoming ITEST as well as competition activities.

An agenda, list of participants, and meeting report are included within the Addenda.

**Advisory Committee Meeting**
The first meeting of the project's Curriculum and Cultural Advisory Committee was held March 15-16, 2010 in Monterey, California. Six of the seven committee members as well as Candiya Mann, the project's evaluator, and the PI/Co-PIs attended.

To help us prepare for the face-to-face meeting, a pre-meeting webinar took place on March 5th. The goal of the webinar was to:

- Provide background information about the MATE Center's ROV competition program, a cornerstone of the ITEST grant
- Review the ITEST proposal and provide details on the specific grant activities, including the work done so far
- Inform advisors where the PIs need their help and expertise
- Assign "homework" so that attendees arrive at the meeting prepared
- Answer questions

While the face-to-face meeting was organized to gather input on specific grant activities and products, it quickly deviated from the agenda. Rather than feedback on any one activity or product, the advisors provided invaluable insight into the middle school world and the challenges that these teachers face in and out of their classrooms. The result was an overall approach to professional development that included workshops as well as curriculum, classroom workspace, administer buy-in, and more. Guidelines for curriculum development and an exhaustive list of books, journal articles, websites, and other resources to help inform and direct the project in its middle school efforts was also produced.

Specific feedback was collected on MATE's existing Summer Institute for Faculty Development in an effort to inform planning for the project's entry-level MATE Summer Institute taking place July 12 – 18, 2010. Advisors infused their own best practices into the institute's agenda and list of activities to help improve the offerings and instruction for middle school teachers. For example, making sure to provide the teachers with adequate time to reflect on what they have learned and network with each other. The advisors also shared strategies for effectively reaching, engaging, and retaining underrepresented student audiences. For example, making sure to include information that addresses the potential concerns of parents, such as: Can I have a family and this career? Will I make enough money to support a family? Will I have to be away from home?

The next Advisory Committee meeting is likely to be "virtual," with members commenting on the draft middle school curriculum. We will poll the advisors to determine the best date for a second face-to-face meeting. One potential is to hold it in conjunction with 2011 entry-level Summer Institute. This would provide the committee with the opportunity to witness MATE's professional development first-hand and allow them to provide very specific comments on the activities and instruction.

A list of committee members, the pre-meeting webinar, agenda, and a summary of resources provided by the advisors are included within the Addenda.

## BROADER IMPACTS

**Expanding the U.S.-based Regional Contest Network**
Since MATE's ITEST proposal was funded, three new U.S.-based regionals joined the MATE competition network. The Pennsylvania Regional ROV Challenge (organized by robotics specialists at the School District of Philadelphia and supported and hosted by Villanova University); the Carolina Regional ROV Competition (organized by a high school instructor and supported and hosted by Coastal Carolina University); and the Wisconsin Regional ROV Contest (organized and hosted by the University of Wisconsin at Milwaukee's Great Lakes WATER Institute and School of Continuing Education and supported by Discovery World and the WIRED Regional Workforce Alliance), took place for the first time in 2010. All three regionals represent substantive partnerships amongst regional K-12 and postsecondary (formal and informal) educational institutions and/or workforce investment boards.

In planning and building the regional competition support infrastructure for the Pennsylvania event, coordinators asked the MATE Center to provide personnel resources to assist them in carrying out a professional development workshop for area middle and high school teachers. In January 2010, ITEST Co-PI and MATE Summer Institute Coordinator Erica Moulton, assisted by a technical professional and students from Villanova University, delivered a 1.5-day professional development workshop for 58 middle and high school teachers. Erica presented and lead instructors through a hands-on design and building exercise using ROV-in-a-Bag, a program funded by the Marine Technology Society's ROV Committee and run by Erica. Participants also received information about the MATE ROV competition, ocean careers, and the ITEST project.

As a result of the workshop and the School District of Philadelphia's established robotics programs and connections with area schools, 34 teams participated in the Pennsylvania competition, which took place on May 15th, 2010. Twelve of these teams were from inner city middle schools taking part in the SCOUT competition class.

**Foreign Regionals Leveraging ITEST**
Four foreign regionals are part of the MATE ROV competition network (Newfoundland and Labrador, Nova Scotia, Scotland, and Hong Kong). The lead coordinating organizations of two of these regionals have used MATE's ITEST grant to leverage support (funding, people, or other resources) to implement similar ITEST grant activities in their areas.

For example, for more than six years the Marine Institute of Memorial University of Newfoundland, the lead coordinator of the Newfoundland and Labrador Regional ROV Contest, has offered marine science and technology summer camps to students from across eastern Canada. The goal of these camps is to provide students with hands-on STEM learning opportunities and raise their awareness of STEM career opportunities.

The students attending the camps are either entering or currently attending high school. Surveys showed that the majority of these students had already identified the courses that they would take in high school to lead them into possible career areas. The coordinators recognized that

informing these students about the opportunities available in the marine sector required an earlier-than-high-school intervention.

The survey results along with MATE's ITEST grant allowed the Marine Institute to leverage its provincial government to provide resources to extend its STEM awareness program to the junior high school grades (7-9). As a result, on March 20th, 2010, the Marine Institute held its first pilot junior high school (SCOUT) level ROV competition, with eight teams from a single school district participating. Schools were provided materials for fabricating the ROVs, professional development for their teachers, and travel to the competition. The Marine Institute also received funding directed to operating the competition itself, including trophies and awards, lunches, and the awards banquet. Given the very positive outcomes, it is expected that funding for the SCOUT program within the Newfoundland and Labrador regional will be increased to allow it to reach and involve more schools next year.

The Robert Gordon University, the lead coordinator of the Scotland Regional ROV Challenge, leveraged their experience and the MATE Center's ITEST grant to connect with the Scottish Young Engineers and Science Clubs program (www.yecscotland.co.uk/ ), a program supported by the Scottish Council for Development and Industry, in its efforts to extend and expand its competition. Currently, the majority of teams participating in the Scotland regional are from the Aberdeen area, but there are several teams from other cities as well as from the West coast of Scotland. In partnership with the Young Engineers program, the university will work to expand participation from Scotland's "Central Belt" (Glasgow and Edinburgh) and also the more remote parts of the Scottish Highlands and Islands, locations that are experiencing some challenging educational, social, and employment issues. In addition to providing the necessary resources for hands-on STEM learning experiences, the hope is to introduce a potential avenue for economic development to these socioeconomically distressed areas.

# ADDENDA

- Evaluation report
- Monterey region
- Pacific Northwest region
- New England region
- Summer Institute
- Regional coordinators' meeting
- Curriculum and Cultural Advisory Committee meeting

# Evaluation of Innovative Technology Experiences for Teachers and Students (ITEST) Grant Activities

# For

# The Marine Advanced Technology Education (MATE) Center

**July 2010**

Submitted by:


**SESRC**

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# Evaluation of Innovative Technology Experiences for Teachers and Students (ITEST) Grant Activities

# For

# The Marine Advanced Technology Education (MATE) Center

Candiya Mann & Kyra Kester

July 2010


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## SPONSORSHIP

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## ABOUT SESRC

The Social and Economic Sciences Research Center (SESRC) at Washington State University is a recognized leader in the development and conduct of survey research.

SESRC-Puget Sound Division provides technical services and consultation to assist clients in acquiring data, understanding what data means, and applying that information to solving problems. The SESRC Puget Sound Division specializes in research design, data collection and analysis, using both qualitative and quantitative methods. The Division also provides interpretive reports, policy studies, presentations and consulting services directly to individual clients, organizations and consortia.

## ACKNOWLEDGEMENTS

The author would like to thank the management at the MATE Center for their leadership, coordination, and helpful suggestions. We are also grateful to the regional coordinators and their support staff, who made themselves available for interviews and provided valuable insights into the project. Finally, this project would not have been possible without the generous and thoughtful input contributed by the student participants, faculty/mentors, and parents who completed surveys.

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# EXECUTIVE SUMMARY

## Evaluation of Innovative Technology Experiences for Teachers and Students (ITEST) Grant Activities

## For

## The Marine Advanced Technology Education (MATE) Center

BY: CANDIYA MANN & KYRA KESTER

SOCIAL & ECONOMIC SCIENCES RESEARCH CENTER, PUGET SOUND OFFICE

WASHINGTON STATE UNIVERSITY

JULY 2010

In September 2009, the National Science Foundation (NSF) funded the Marine Advanced Technology Education (MATE) Center's proposal for an Innovative Technology Experiences for Students and Teachers (ITEST) grant. Through this grant, the MATE Center planned to support middle school students and teachers by expanding the entry-level (SCOUT class) ROV competition, providing marine STEM career information targeted to this age range, and building ROVER, a cyber-learning center, to support them.

The evaluation is based on multiple data sources (primarily surveys and interviews) and reflects the input of a variety of stakeholders, including middle school students, teachers, parents, regional coordinators, community college students, and MATE management and staff. This report covers grant activities that took place between September 1st, 2009 and June 30th, 2010. It describes the project implementation as well as the preliminary findings for each of the research questions.

## Project Implementation

The first nine months of the grant focused primarily on grant Objective One: building the support infrastructure for an entry-level ROV competition. The four regions implementing the project in the first year were Monterey Bay, the Pacific Northwest, New England, and Southern California. As expected, the regions took a variety of approaches to implementing the grant, relying on each region's unique strengths and responding to their distinct challenges. An overview of the implementation approaches for each region is presented below.

In the Monterey Bay, the program was implemented through working with the coordinators of After School Academies at two school districts. The program sent MATE staff to the schools weekly to provide technical support. The program offered two culminating events in the spring of 2010: participation in the regional ROV competition and a school district "ROVER Night". Fifteen new SCOUT class teams participated in the culminating events in the Monterey Bay region. It should be noted that Monterey is the only region that had a robust SCOUT competition prior to grant implementation, with 46 non-ITEST SCOUT teams participating in the regional competition.

The Pacific Northwest program worked with multiple schools in multiple districts. The regional coordinators hired a graduate student to manage teacher outreach and communication. Regional coordinators and Marine Technology Society members performed student outreach by visiting schools and making presentations to approximately 1,500 students. Technical support was provided to teams via a series of workshops for teachers, students, and parents. They created a mini-grant program to distribute supplies and tools to teams. This region was particularly successful at involving parents, and many teams were mentored by parents. Twenty-four new SCOUT class teams participated in the regional ROV competition, up from one team the prior year.

In the Southern California region, the program was implemented by working with a single school district plus one private middle school academy. After attaining School Board approval, teacher and student recruitment was performed by the school administration. Long Beach Community College students, who were also Explorer class ROV team members, were paired with ITEST teachers to provide technical assistance to the teams. The college students visited the middle schools to provide assistance at least once per week, as requested by the teachers. The involvement of college students was noted as a successful approach by all stakeholders. Twelve new SCOUT class teams participated in the Southern California regional competition. This was the first year that SCOUT teams participated in this regional event.

The New England region worked primarily with two after-school programs: the Citizen's Program and the Boys and Girls Club of Fall River. The regional coordinator assigned engineering students from Bristol Community College to work with each of the programs. The college students developed a 10-week curriculum and taught it to the students in these programs. There were two 10-week sessions culminating in two mini-competitions, one in the fall and one in the spring. A total of six new SCOUT class teams participated in these mini-competitions.

All of the regions successfully implemented the grant in that the number of SCOUT class teams participating in the ROV competition increased markedly in all four regions.

# Preliminary Findings

The preliminary evaluation findings indicate that the MATE Center's ITEST project is achieving the expected outcomes. The project strategies that were implemented in the first year of the grant are reviewed below.

## Project Strategy 1: Provide Professional Development

- **Increased confidence facilitating STEM learning experiences:** In the post-workshop surveys (N=30), all of the respondents (100%) stated that they felt more confident facilitation STEM experiences.
- **Strengthened commitment to participate in the program:** As a result of the training, 89% of the workshop attendees indicated that they felt more committed to participating in the competition.

## Project Strategy 2: Support the Development of the SCOUT (Entry Level) ROV Class

- **Increased Awareness of STEM Careers:** After building their ROV, 97% of the students surveyed (N=98) indicated that they knew more about careers in marine STEM.
- **Increased Interest in STEM Careers:** Seventy-one percent (71%) of the students stated that their ROV project made them more interested in a marine career.
- **Increased Interest in STEM:** Three quarters of the students (75%) indicated that their ROV project made them want to learn more about ocean STEM. Ninety-five percent (95%) of the parents surveyed (N=80) stated that building an ROV made their child more interested in STEM.
- **Increased STEM Knowledge & Skills:** Parents reported that building an ROV contributed to improving their children's grades in science (72%), math (55%), computers (61%), and engineering/robotics (76%).
- **Increased SCANS Skills:** All of the teachers/mentors surveyed observed increases in their students' skills in team building, problem solving, and/or critical thinking. Seventy percent (70%) of parents reported that their children were better able to work with others due to their involvement in the ROV project; 70% indicated that their child's self confidence improved; and 28% marked that their child was better organized.
- **Increased Parental Support of Their Children's Interest in STEM:** Eighty-one percent (81%) of the parents indicated that participation in the ROV program changed how they envisioned their child's future, making it easier to picture their child with a STEM career.

The remaining project strategies will be evaluated in future grant years as they are implemented.

## Preliminary Findings by Gender and Ethnicity

Overall, positive results were found regardless of gender or ethnicity, including the following:

- increased awareness of and interest in STEM careers,
- increased interest in studying STEM topics, and
- increased STEM knowledge.

In general, the ROV program appeared to generate stronger gains in the boys than the girls and in the white students than the minority students. A few findings ran counter to this trend. Female students were slightly more likely than male students to indicate that they wanted to learn more about undersea volcanoes (male: 65%; female: 69%). Minority students showed slightly greater gains than the white students in their desire to take courses in math (white: 37%; minority: 41%) and substantially more interest in courses in engineering (white: 9%; minority: 29%).

One of the goals of the grant is to help determine the most effective strategies for engaging youth of diverse backgrounds. The project proposes several different strategies for improvement in this area. Future evaluations will track the implementation of these strategies to reach out to underrepresented students, the effectiveness of these strategies in increasing the participation of these students, and the differential impacts on student outcomes.

# INTRODUCTION

In September 2009, the National Science Foundation (NSF) funded the Marine Advanced Technology Education (MATE) Center's proposal for an Innovative Technology Experiences for Students and Teachers (ITEST) grant. The MATE Center's ITEST program, titled *MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce*, leveraged their extensive network of remotely operated vehicle (ROV) student competitions. In the past, the ROV competitions mainly focused on students at the high school, college, and university levels. This grant enabled the MATE Center to support middle school students and teachers by expanding the entry-level (SCOUT class) ROV competition, providing marine STEM career information targeted to this age range, and building ROVER, a cyber-learning center, to support them.

As stated in the proposal, the project's objectives are fourfold:

- Objective 1: Build the support infrastructure for an entry-level ROV competition class by
    - a) providing professional development and student support workshops in after-school and informal settings; and
    - b) developing, adapting, and enhancing ROV-focused STEM curriculum materials.
- Objective 2: Increase ocean STEM career awareness and present trajectories to those careers for middle and high school audiences.
- Objective 3: Build a cyberlearning center to
    - a) foster collaboration and increase communication among students, educators, parents, and working professionals; and
    - b) improve access to STEM instructional resources. (In this project, cyberlearning refers to the use of cyberspace or "cyberconnections" to advance learning.)
- Objective 4: Evaluate and track project participants to determine the impact on a) students' STEM knowledge, skill development, and inclination to pursue STEM education and careers; and b) teachers' confidence in facilitating STEM learning experiences and delivering career information.

This report covers grant activities that took place between September 1st, 2009 and June 30th, 2010. The results are presented below in two chapters. The first chapter, *Project Implementation,* describes how the ITEST grant has been implemented in the first year. The MATE Center proposed a staged geographic roll-out of the grant, with four regions implementing the grant each year. As expected, the four regions implementing in year one used a variety different strategies to accomplish the grant's goals. The differing regional approaches are explored in this chapter.

The second chapter, *Preliminary Findings*, discusses the preliminary results of the outcome evaluation. This chapter covers the evaluation questions listed in the methodology section below and includes analysis by demographics.

The MATE Center's ITEST grant evaluation was performed by the Puget Sound Division of the Social and Economic Sciences Research Center at Washington State University.

# METHODOLOGY

The evaluation connects each of the project strategies with research questions and expected outcomes of the project. These strategies and research questions are presented below. Please see the Appendix for the detailed evaluation plan, including the expected outcomes, data sources, and evaluation schedule.

**Table 1: Project Strategies and Research Questions**

| Project Strategy | Research Questions |
|---|---|
| 1. Provide professional development: workshops and Summer Institutes | 1.1. Did the teachers gain confidence facilitating STEM learning experiences through the workshops?<br><br>1.2. What was the impact of the workshops on the teachers' decision to participate in the ROV competition?<br><br>1.3. Did attendance at the Summer Institutes lead to greater awareness/understanding of ocean STEM careers? |
| 2. Support the development of the SCOUT (Entry Level) ROV Class | 2.1. To what extent did participating in the ROV program lead to an increase in the students' interest in STEM and STEM careers? Did educators and parents observe an increase in the students' interest in STEM and STEM careers as a result of the program? An increase in the students' STEM knowledge and skills and SCANS skills?<br><br>2.2. Did participating in the workshops (or observing the competitions) lead to an increase in the parents' support of their children's interest in STEM careers?<br><br>2.3. Were the curriculum materials and workshops at the appropriate level for a middle school audience?<br><br>2.4. What was the impact of the workshops and other support on the teams' ability to build an ROV and participate in the regional competitions? |

| Project Strategy | Research Questions |
|---|---|
| 3. Modify career guidance resources to better suit middle & high school students | 3.1. Has the *Exploring Ocean Careers* course and web site been modified so that the appeal, information and delivery are appropriate for the middle and high school audience?<br><br>3.2. Did students, educators and parents use the career guidance tools? Did their awareness of ocean STEM careers increase as a result of these tools? |
| 4. Build ROVER, a cyberlearning center | 4.1. Has ROVER increased access to career and instructional resources? Increased use of the resources?<br><br>4.2. To what extent were the website users satisfied with the ease-of-use of the website? With the materials available through the website?<br><br>4.3. Has ROVER increased communication between students, educators, industry professionals, and parents?<br><br>4.4. Did the availability of ROVER affect the teams' ability to build an ROV and participate in the regional competitions? |

## DATA SOURCES

The evaluation relies upon multiple sources of data. The data collection includes input from a variety of stakeholders, including students, teachers, parents, regional coordinators, college students helping with grant implementation, and MATE staff. Below are descriptions of each of the data sources.[1] All of the surveys were developed in collaboration with MATE staff and regional coordinators.

### Pre and Post Teacher Workshop Surveys

Pre and post paper surveys were administered to teacher workshop attendees in the Monterey, Pacific Northwest, and New England regions at the beginning of the workshop day and at the end of the training. The surveys addressed issues of teacher confidence facilitating STEM learning experiences, commitment to bringing a team to competition, concerns about mentoring students in designing and

[1] Please see Appendix for survey and interview protocols.

building an ROV, expectations of the workshops, and additional ways that the regional coordinators and the MATE Center could support the participants. Surveys were tallied in Microsoft Word and Excel.

### Post Competition Surveys of Students

At the ITEST SCOUT class competitions, students were asked to complete surveys. The survey protocol was a modified version of the student survey that has been administered to over 1,500 students over the past five years at regional and international ROV competitions. The survey covered the following topics: awareness and interest in ocean STEM careers, increased desire to take STEM courses due to involvement in the program, awards/honors received as a result of competition experience, and self-assessment of change in STEM knowledge.

Student surveys were collected at the Monterey, Pacific Northwest, and New England regional events. At the Monterey regional competition, surveys were completed online via Survey Monkey. All other surveys were conducted via paper forms later entered into Survey Monkey. The Monterey and New England regional competitions offered incentives to complete the survey. At the Monterey competition, the students received raffle tickets for prizes that were raffled off at the end of the day. At the New England competitions, students received a competition t-shirt as an incentive. Data was extracted and analyzed with the Statistical Package for the Social Sciences (SPSS). Preliminary analysis of student survey data was conducted by gender and ethnicity.

### Post Competition Surveys of Teachers/Mentors

Teachers/team mentors also completed surveys at the ITEST SCOUT class competitions. The survey protocol was a modified version of the faculty/mentor survey that has been administered to over 400 respondents over the past five years at ROV competitions. The survey addressed topics such as the value of the competition, incorporation of competition into course curriculum, interest in participating in future competitions, assessment of change in their students' STEM knowledge/skills, SCANS skills, and interest in STEM careers, and related topics.

Teacher/mentor surveys were collected at the Monterey and Southern California regional events. At the Monterey regional competition, surveys were completed online via Survey Monkey. Teachers/mentors in the Southern California region received email invitations containing a link to the survey. Data was extracted and analyzed with SPSS.

### Post Competition Surveys of Parents

In contrast to the student and teacher/mentor surveys, which have been conducted for years at MATE ROV competitions, this was the first year parent input was solicited. Paper surveys were administered to parents at the ITEST SCOUT class competitions in Monterey, Pacific Northwest, and New England. Parent surveys addressed the topics of parental support of their children's interest in STEM and STEM careers, the value of the competition, and changes they have observed in their children since they became

involved in the program. Data was entered into Survey Monkey and analyzed using the tools within the website.

### End of Program Follow-up Surveys of ITEST Teachers/Mentors

In some regions, ITEST teams competed next to non-ITEST teams at regional events. The same post-competition teacher/mentor survey was administered to all teams. In order to avoid asking non-ITEST teachers/mentors questions that only applied to the ITEST teams, a separate web survey was conducted. ITEST teachers/mentors received an email invitation to participate in the survey, containing a link. The survey asked the respondents to rate the ROV program and the support they received and to report on the obstacles they faced and suggestions for how the program could better support them. The response rate was very low, with only six responses received. Next year, we will explore ways to combine this survey with the post-competition survey of teachers/mentors. Responses were submitted by teachers in the Monterey and Pacific Northwest regions.

### Interviews of MATE Center Staff

Structured interviews were conducted with MATE regional coordinators from all four regions implementing the grant in year one, students involved in implementing the grant activities, and the grant PI. The interviews solicited information such as detailed descriptions of grant implementation (recruitment of students and teachers, workshops and other methods of providing technical assistance, other support provided to teams, partnerships with other organizations, and staffing), effectiveness of the workshops, observations on student outcomes, parental involvement, successes/program strengths, challenges, changes planned for next year, and ratings of the MATE Center's support of the regions implementing the grant.

### Other Data Sources

Additional data sources informing the evaluation include the annual reports turned in by the regional coordinators to the ITEST grant PI, demographic information collected from the schools, clubs, and teams, observations of the Pacific Northwest regional competition, the regional coordinators meeting, and the Advisory Committee meeting, review of participation data, and document review, such as curriculum and supporting technical materials and the MATE Center's annual report.

### Challenges and Weaknesses of the Evaluation

Unfortunately, as this was the first year of the evaluation, the survey implementation was somewhat uneven, and the data does not cover all of the regions. Regional coordinators were responsible for administering the surveys. With the quick project ramp-up, regional coordinators were pulled in many different directions, and occasionally, survey implementation was forgotten. We intend to improve the data collection efforts in year two of the evaluation by stressing the importance of the data collection in

communication with the regional coordinators. We will provide them with a complete set of data collection instruments at the Regional Coordinator's meeting at the beginning of the program year, along with a training on how and when to implement each. In addition, the demographic data collection tools will be revised to streamline the data collection process and improve the quality of the data.

While the variety of project implementation methods is a strength of the program, it introduces challenges to the evaluation design. The goal is to apply the same evaluation data collection methods to all regions. Some of the original data collection plans had to be changed because they would not be possible in all regions. For instance, the evaluation plan originally called for pre-surveys of students prior to attending an introductory workshop about the program. In practice, none of the regions offered an introductory workshop for students. Thus, the student pre-survey was removed from the evaluation.

An additional difficulty of this evaluation report was the timing of the report. Given the fact that the regional competitions took place as late as June 12th, it was a challenge to complete data entry and analysis prior to the report deadline. In the future, we plan to change the competition surveys to a scannable format so that data input will be much faster. An additional distraction was the MATE ROV international competition in Hilo, Hawaii, which took place in late June. All of the regional coordinators, the ITEST PI, and the evaluator attended the international competition.

With the tight turn-around between the end of the regional competitions and the evaluation report, the participation numbers were not available prior to writing this report. Thus, it was not possible to calculate response rates for each of the surveys. We hope that with better advance planning next year, we will be able to remedy this weakness.

# PROJECT IMPLEMENTATION

This chapter reviews the progress towards implementing each of the four grant objectives. Each of the four objectives is discussed in turn, followed by a summary of additional grant activities that the MATE Center has performed in support of the overall grant.

## OBJECTIVE ONE

*Objective 1: Build the support infrastructure for an entry-level ROV competition class by a) providing professional development and student support workshops in after-school and informal settings; and b) developing, adapting, and enhancing ROV-focused STEM curriculum materials.*

The first nine months of the grant focused primarily on grant Objective One. Thus, this report section comprises the bulk of the chapter. This section discusses each of the four regions that implemented the grant in year one: Monterey Bay, Pacific Northwest, Southern California, and New England. The goal of the section is to highlight the differences in regional grant implementation: strengths, challenges, and unique approaches. This section also reviews the progress preparing for the ITEST Summer Institute.

### MONTEREY BAY

#### Unique Features of Regional Implementation

- Worked with the coordinators of after school programs at two school districts
- Implemented ITEST activities in the context of a region with an existing robust SCOUT class competition (e.g., 49 SCOUT class teams registered for the 2010 regional competition)
- Sent MATE staff for weekly visits to the schools to provide technical support
- Offered two culminating events: participation in the regional competition and a separate school district ROVER night

#### Staffing

The Monterey Bay regional coordinator is Jill Zande, the MATE Center Associate Director and ITEST PI. Jill was responsible for managing the grant implementation in the Monterey region. Kim Swan, Teen Programs Manager at the Monterey Bay Aquarium, helped with school recruitment. Technical support in the classrooms was supplied by Matt Gardner, MATE Competition Technical Manager and Head Rules Judge, Jim Davidson, retired mechanical engineer, and two Monterey Peninsula College students. The teacher workshops were taught by Jill, Matt, and Jeremy Hertzberg, Automotive Technology Laboratory Technician and Instructor, Monterey Peninsula College.

## Implementation Overview

As soon as Jill received word that the grant would be funded, she began reaching out to her regional recruitment collaborators. Her ITEST recruitment targeted the two regional school districts serving youth who are consistently under-represented in math and science courses, including low-income and minority students: the Pajaro Valley Unified School District (PVUSD) and the Monterey Peninsula Unified School District (MPUSD). Both districts serve a high proportion of low-income, Hispanic, migrant students.

Through the Monterey Bay Aquarium's Community Partnership Program, Jill was put in touch with the PVUSD after school program. Jill made three visits to the PVUSD: one to meet the director, one to present to the middle and high school after school program coordinators, and one to speak with the staff of the Gifted and Talented Education (GATE) program, who had expressed interest in the ROV program. Many of the middle school after school program coordinators were interested in the ROV program. They passed along information about the program to their middle school teachers who were also interested. Only one school in the PVUSD ended up participating in the program in the 2009-2010 school year, but there is continued interest from the coordinators and the GATE program. District participation may increase in future years.

In parallel with the PVUSD recruitment efforts, Jill reached out to the After School Academy (ASA) through MPUSD. She held meetings with the director and presentations with the middle school and high school ASA coordinators. While the ITEST grant did not fund the program in high schools, Jill still found it useful to speak to the high school coordinators so that when the middle school students transfer to high school, the high schools are aware of their ROV experiences and may be interested in starting the program at the high school level as well.[2] The director of the ASA program decided to move forward with implementing the ROV program, and she mandated that the middle schools implement the ROV program as an ASA activity. This was a mixed blessing. While this decision resulted in five MPUSD schools implementing the program, since the teachers did not self-select into the program, some of them were not as excited as others to participate.

The Monterey region held the earliest teacher workshop of the four ITEST regions, in November. Five MPUSD schools and one PVUSD school attended. Some schools sent a teacher as well as an ASA coordinator, while others only sent a coordinator. One school sent a teacher, coordinator and parent. Over the course of the program, Jill noted that the schools that sent a teacher to the training were the most likely to successfully implement the program.

[2] At least one MPUSD high school already has an ROV team: MAOS.

As a side note, there was enough interest in the ROV program from high school teachers that the Monterey Peninsula College Tech Prep program provided funding for the MATE Center to offer a separate teacher workshop for the high school teachers.

By the end of January, the teachers received all of the supplies, equipment, and tools to start building the ROV's. In addition, Jill provided a CD of curriculum and technical resources and a proposed course outline.

The original implementation plan called for the region's strong cadre of industry volunteers to visit the schools weekly to provide technical support to the teachers and students. In practice, Jill found that the group of active volunteers was already fully taxed with supporting the existing SCOUT class participants (providing wiring workshops and similar activities). Instead, MATE staff, one volunteer, and/or two MPC students visited the schools on an as-needed basis, and the teachers/mentors visited Monterey Peninsula College to speak to the MATE staff on an as-needed basis. While this level of support resulted in teams bringing functioning vehicles to the culminating events, Jill noted that since the teams met twice a week, it would be ideal for them to have technical support available at both meetings.

In addition to the technical support provided by MATE Center personnel, one MPUSD team received support from a student at California State University, Monterey Bay (CSUMB) in the service learning program, and one PVUSD team received support from his school's MESA program.

An additional potential source of support for the middle school teams was the Monterey Academy of Oceanographic Sciences (MAOS) at Monterey High School.[3] This group has a robust ROV program with many years of experience competing at MATE ROV events. The director of the MAOS ROV program was excited to get involved, envisioning that it would help to solidify his current students' learning as they mentored the younger students and that it would help him recruit incoming high school students to his MAOS program and ROV team. The plan was to pair the MAOS students with the teams from a MPUSD school located close to Monterey High School. In the 2009-2010 grant year, the MAOS program did not end up becoming involved with supporting an ITEST SCOUT team because the middle school they were planning to work with did not organize a team due to turnover in the ASA coordinators. In the next grant year, a middle school teacher who attended the ITEST Summer Institute will be moving to this school. It is likely that the school will field an ROV team next year, and the MAOS program plans to support this team.

The ITEST teams were invited to participate in the two pool practice days (in March and April) that were offered to all of the SCOUT teams in the region. Three of the ITEST schools took advantage of these practice days.

[3] Jill is on the Advisory Board for MAOS.

On April 24th, the Monterey regional competition was held. Forty nine SCOUT class vehicles competed, four of which were the ITEST SCOUT teams that attended the pool practice days. Three teams were from MPUSD and one was from PVUSD. All four teams performed well, with functioning vehicles.

Because the regional competition already serves so many SCOUT teams, it was unable to accommodate a large influx of all of the SCOUT class teams. Therefore, the ITEST schools were directed to hold internal run-off competitions and to send the best team per school. As noted above, only four teams had vehicles ready to compete by mid-April so only one school used an internal selection process to determine which team to send to the regional competition.

Since only four ITEST teams competed in the regional competition, the ROV program offered a second culminating event, the MPUSD ROVER Night. This event was held on May 26th at the Monterey High School pool. The MAOS program supported the event, and the director of the MAOS ROV program attended. Students, teachers, parents, and the CSUMB student attended. Students received certificates of participation, and the 10-12 teams had a chance to participate in a mini-competition.

### Successes/Program Strengths

- The ROV ITEST program made connections with many different organizations and individuals, including middle school and high school coordinators at two districts, the GATE program, the Tech Prep program, and the MAOS program. Some of these connections paid off in this year of the grant and others will continue to be developed in future years.
- Similarly, the connections with feeder high schools were a strength of the program. While this grant does not specifically focus on high schools, it is positive to see increasing awareness and participation in the program among high schools that the middle school students will attend. High schools in the PVUSD and MPUSD attended the high school teacher workshop, and at least one high school plans to start a team for the first time due to this outreach.

### Challenges

- It was a significant time investment to make the connections with the schools in these districts.
- Selecting the timing for the initial teacher workshop was a challenge – allowing teams enough time to prepare for the regional competition but not so much time that they lose motivation over the holidays.
- It was a challenge learning how to work effectively with these school districts: how the after school academy worked and how best to work with the middle school audience.
- Working with teachers who did not self-select for the program meant that the internal teacher motivation and excitement was not always present.
- The fact that there was already a robust SCOUT class in the region created challenges. For instance, many of the schools and/or teachers that would be “easy” to motivate to participate were already involved in the program. Additionally, the existing cadre of volunteers was not able to take on any additional commitments due to their involvement with the large group of non-

ITEST SCOUT teams. The ITEST teams required support at the same time of year that the support activities started up for the non-ITEST teams.

- It was a challenge that the grant PI was also acting as a regional coordinator. Both of these roles have significant time commitments and responsibilities.

### Changes for Next Year

- The schools will be required to send a teacher to the teacher workshop. After school coordinators will be welcome to join the teachers but not to attend by themselves.
- Jill plans to reach out to the middle school principals to try to engender program support from the administration of the schools.
- The teacher workshop will be offered in January in order to eliminate the long wait between the November workshop and January start date.
- The program will start recruiting volunteers earlier in the grant year and will reach out to new sources of volunteers. Specifically, they will reach out to college students, explore coordinating with the schools' service learning requirements, and offer volunteer training. The MPC Vice President of Student Affairs has committed to working with the program to recruit underrepresented college students to serve as volunteers.
- The ITEST grant proposal calls for recruiting a new group of middle school teachers each year. In the Monterey region, they will change this plan. They will bring in a few new middle school teachers but mainly continue to train and support the teachers who were involved in this year's program. Jill is worried that without continued support these teachers will not continue to mentor ROV teams. She plans to change the regional grant focus from impacting a larger number of teachers and students to focusing on program sustainability and the quality of support offered to these teachers and schools.
- They are considering the possibility of adding teacher/student wiring and waterproofing workshops.
- Next year, they are planning to shift some regional coordinating duties to Matt. Jill will still be available to support the regional efforts, but this will reduce the load of holding down two roles at the same time.

# PACIFIC NORTHWEST

## Unique Features of Regional Implementation

- Worked with multiple schools in multiple districts
- Performed student outreach school visits and presentations (regional coordinators and Marine Technology Society members)
- Hired a graduate student to manage teacher outreach and communication
- Created mini-grant program for teams

## Staffing

The regional coordinators in the Pacific Northwest are Fritz Stahr and Rick Rupan, both professional staff in the School of Oceanography at the University of Washington (UW). Fritz was responsible for managing and administering the grant in the region. He also taught the workshops, performed some outreach, and coordinated the regional ROV competition. Rick's main responsibilities were outreach, workshops, and being the main team contact for technical help in building their vehicles. Through ITEST funds, Fritz and Rick hired Kailey Genther, a graduate student pursuing her Masters in Marine Affairs at UW. Her responsibilities were recruiting teachers and acting as the main team contact for administrative items (workshops, sourcing supplies and tools, etc.). Over the course of the program, her total salary was roughly $2,300.

## Implementation Overview

In the PNW, Fritz and Rick kicked off the grant by hiring Kailey in the fall of 2009. Kailey brought a background in science education and outreach. She was charged with recruiting middle school and junior high teachers, especially those working in schools with a high proportion of minority and low income students.

To recruit teachers, Kailey's strategy was to create a flyer advertising the upcoming teacher workshop in December.[4] She mailed five copies of the flyer to every middle school and junior high in the Puget Sound area (roughly 150), directed to the schools' science or engineering departments. In addition, the flyer was emailed to teachers who were involved in prior MATE ROV competitions as well as teachers involved in the Ocean Inquiry Project. She then handled all inquiries generated by the flyers. The goal was to find 10 teachers for the workshop, but they ended up enrolling 12. (Two schools sent two teachers apiece.) One high school teacher expressed interest but was unable to participate because of the grant's focus on the lower grade levels.

[4] Please see appendix for a copy of the flier.

At the December workshop, each participant was provided with an "ROV in a bag", all the components to build an ROV. Fritz and Rick taught them to assemble it. In the afternoon, they were able to fly it in the pool, and they left that day with their own ROV. The regional coordinators noted that many of the teachers had minimal technical skills so the instruction needed to start from scratch. (This was common across all of the regions. When the grant was written, it was expected that middle school teachers would lack technical skills, and one of the goals of the grant was to help teachers feel more comfortable facilitating STEM learning experiences, even if they had weak skills in this area.) During the workshop, participants were able to sign up for follow-up school visits, where a representative of the program would come to their school and talk to their students. The regional coordinators mentioned that they thought this was an important piece of ongoing support that helped the teachers feel more comfortable with the program.

The school visits started in January 2010. Overall, Rick completed five school visits, Fritz did one, and two representatives of the local Marine Technology Society (MTS) presented at a school apiece on dates when Rick and Fritz were not available.[5] (The MTS representatives had participated in the ROV competition in the past so were very familiar with it.) The school visits were all-day affairs, where the presenter would talk to roughly 25 students at a time and speak to four to five classes per day, plus often an after school club as well. In total, the school visits involved contact with over 1,500 students.[6] The presentations included information about the MATE Center, ROV's, the ROV competition, and careers in oceanography. Rick and Fritz brought props as well: an ROV, a sea glider, and an argo float.

The goal of the presentations was to motivate students to form a team, build an ROV, and participate in the regional competition. Towards that end, each student attending a presentation left with a flyer telling them to contact Rick if they were interested. The regional coordinators found these flyers to be very effective. In many cases, the students took the flyers home and spoke to their parents who contacted Rick. The parents often became the team mentor, rather than the teachers. In some cases, a single teacher's class had multiple teams, with the parents acting as team mentors and the teacher overseeing them all. One example was a student who attended a presentation, brought the information home and told his sibling about it. His mother contacted Rick and ended up mentoring two teams, one for each of her children.[7]

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[5] The Pacific Northwest region of the MATE ROV program has a close relationship with the Puget Sound Section of MTS. Many of the MTS members serve as volunteers and judges at the regional competition event, and MTS member organizations are major donors to the regional MATE ROV program. In addition, the regional MATE ROV program has coordinated with the local chapter of MTS to handle the accounting and disbursement of ITEST funds.

[6] This is calculated as seven schools at 200-250 students apiece.

[7] It was not uncommon for multiple children from the same family to be involved in the competition. Across all the ITEST regions, 14 percent of the parents responding to the post-competition survey (N=80) had two or more children participating in that day's competition.

A unique element of the Pacific Northwest ITEST implementation was the mini-grant program that they developed.[8] In order to ensure that financial constraints would not prevent teams from building an ROV, Fritz and Rick reallocated their ITEST funding, basically shifting some of their salary towards this mini-grant program.[9] Each ITEST team was offered the opportunity to apply for supplies or specialty tools, whatever they needed to build their ROV. Instead of providing money, the program purchased the materials for the teams. This offered the dual advantages of allowing the coordinators to find bulk discounts on some items and relieving teams of the often difficult task of finding sources for these specialty items. All of the teams received a grant, and most received everything that they requested. The grant materials were ready for the teams to pick up at the wiring workshop.

The next event held was a wiring workshop in March for students, teachers, and parents. This was a very popular workshop with over 50 attendees. Interestingly, only three of the adult attendees were teachers, and the rest were parents mentoring teams. (Exact counts are not available.) This was a much larger crowd than expected, but they were able to accommodate everybody. All of the teams left the wiring workshop with a working controller. As reported by Rick, the majority of teams that attended this workshop made it to the regional competition – all but two teams.

Other support activities included a half-day meeting to discuss the competition. Individual help was provided to teams as requested. Two teams requested help from Rick and came to the University of Washington to work with him one-on-one. He provided advice on topics such as wiring, ballasting, and piloting.

Some teams had difficulty finding a body of water for testing the vehicles so Fritz and Rick opened the test pool at the School of Oceanography for two practice days of four hours each. Students came and tested their vehicles, and Fritz and Rick helped troubleshoot any issues. Seven teams attended the first pool day, and six attended the second.

Prior to the regional competition, two of the team mentors (one parent and one teacher) volunteered to help build the mission props.

The culminating event for the Pacific Northwest ITEST teams was participating in the regional competition. In the 2009 regional competition, three SCOUT class teams registered, and only one actually competed. In the 2010 regional competition, 24 SCOUT class teams competed, comprised of 101 students. At the competition, several of the Explorer class college students acted as SCOUT class judges.

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[8] See addenda for mini-grant application form.

[9] All of the regions provided supplies, equipment and/or tools to teams, but the PNW was the only region to create a formal mini grant process.

The retention rate was about the same between the SCOUT class and the Ranger class. One of the 11 Ranger teams dropped out, and two of the SCOUT class teams dropped out. At the same time, new teams formed and registered. This last minute "flux" of teams follows the patterns of prior years' competitions.

### Successes/Program Strengths

- The main accomplishment was the sheer number of new SCOUT class teams (24). The regional coordinators attributed this to the availability of funding for supplies, both for the teachers' "ROV in a bag" kits and for the students' ROV's.
- The mini-grant program was an effective method to ensure that each team received the core materials they deemed necessary to build their vehicle.
- The connection with the University of Washington School of Oceanography was another strength of the program. The UW administration supports the use of department facilities and resources for this program. This includes meeting space for workshops, the test pool, tools, and leftover supplies from other department projects.
- The intense parental involvement also strengthened the program. The fact that so many teams were mentored by parents enabled multiple teams to come from a single classroom.
- Hiring Kailey to perform the outreach was a good decision, since she had more experience working with the school districts than the coordinators. She knew how to design an effective outreach campaign, and her assistance in coordinating the communication with the teachers and teams helped the coordinators focus on the technical side and managing the logistics.
- The school visits were an effective method of supporting the teachers who attended the workshop as well as recruiting students for the program. The presentations also provided STEM career information to a much broader audience of students. Handing flyers to the students to bring home worked well to generate parental support of the program.

### Challenges

- Managing the growth of the program was a challenge. The ROV competition tripled in size from the prior year, increasing the complexity of the logistics. For instance, the larger number of teams meant an increase in the number of volunteers needed (70 volunteers were involved at the 2010 regional competition).
- The other major challenge was recruiting the targeted groups. The coordinators were pleased with the number of girls involved in the competition but did not meet their goals for the minority and low income participation. Rick did school visits to three schools in particular with a high proportion of minority and low income students, but program participation in those schools was minimal.[10] He attributes the lack of participation from these schools to an absence of parental support for the program. In the other schools, parents were very involved in

[10] Note: Rick is of minority background. In other MATE Center research, outreach to minority students was found to be more effective when performed by outreach personnel who were also of minority background.

mentoring the teams and were a major source of support for the teachers. In this region, major employment sectors include information technology and manufacturing. (For instance, Microsoft and Boeing are based in the Puget Sound). Anecdotal reports suggest that in many cases, parents were able to provide the technical skills that the teachers lacked. In classrooms without this parental support, teachers were too overwhelmed by the other demands on their time to participate successfully in the program. Rick plans to develop a cadre of industry professionals (e.g., former ROV competition judges) who can be matched with individual teachers to provide technical support for building the ROVs.

- With the large number of teams from the various schools and districts, communication and tracking who needed which materials and information was a challenge. It worked well to have dedicated staff to handle communications (Kailey and Rick).

### Changes for Next Year

Several changes are being contemplated for next year:

- An additional team member will be brought into the leadership team. Wes Thompson will help with the competition logistics.
- As mentioned above, Rick would like to create a group of professionals available to provide technical advice to the teams.
- The competition has reached the maximum capacity for a one-day event in the current venue. They do not want to expand to a two-day event, due to financial and logistical constraints. This means that they will need to find a way to limit the number of teams. They are considering proposing that schools with multiple teams hold an internal competition and send their top one or two teams to the main regional competition. They are also considering limiting the grades allowed to compete. (Some elementary schools participated this year.)
- An additional change for next year will be that all team protests during the competition need to come from the team captain. No parents, mentors, or other team members will be allowed in the judging room.

## SOUTHERN CALIFORNIA

### Unique Features of Regional Implementation

- Worked primarily with a single school district plus one private middle school academy
- Attained School Board approval then student and teacher outreach was performed by the school administration
- Paired Long Beach Community College (LBCC) students, who were also LBCC Explorer class ROV team members, with teachers to provide technical assistance to teams

### Staffing

The regional coordinator for Southern California is Scott Fraser, Electronics Department Head at Long Beach Community College (LBCC). Implementation in Southern California involved the participation of five LBCC students in electrical program. These students were also on the LBCC Explorer class ROV team. The students were paired with teachers at the teacher workshops. Throughout the program, the students then visited their teachers' school regularly, providing technical support for the teams. The LBCC students received a stipend for 40 hours of work, though they all worked more hours than this. The students called the stipend "nice to have" though they explained that they "would have done it for free". They did not receive any school credit for their work.

### Implementation Overview

In order to begin implementing ITEST in his region, Scott was required to obtain Board approval from LBCC then from Long Beach Unified School District (LBUSD). This process involved a significant investment of time. By November, both Boards had approved the project. After surpassing this hurdle, the recruitment of teachers and students went very quickly. The superintendent of middle schools selected four schools to participate; the schools selected several science teachers; and the teachers selected the students. Scott reports that most of the teachers were very excited to participate. Only one school was unsure if or how they wanted to get involved. One team did their ROV activities during the school day, and the others held their ROV team meetings after school.

One school outside of the LBUSD also decided to participate in the program. This private middle school academy serves 90 percent African American and 10 percent Hispanic students. The involvement with this school came through one of the past LBCC ROV team members who had contacts in this school. Scott contacted the two principles, and they agreed to participate.

None of the schools had any of the necessary equipment so Scott put together five identical sets of equipment and tools that he supplied to the schools. As an interesting side-note, one of the schools contacted him after the competition to find out where they should return the tools. They were surprised and touched to find that it was theirs to keep, hopefully for use by future ROV teams.

The Southern California region started their program with an all-day teacher training workshop in February. At this workshop, teachers were paired with LBCC college students in the electrical program, based on proximity of the student's home to the teacher's school. The students continued their involvement with these teachers by visiting their schools at least weekly. The role of the LBCC students was to help as requested by the teacher. Some teachers were very self-sufficient, while others required much more hand-holding. In one case, the student visited the teacher's school four days per week, even going so far as to purchase a textbook and create a curriculum to help the teacher explain the science behind the technology. In other cases, the LBCC students acted in more of an advisory capacity.

Another all-day workshop was held in March, then in April there was an all-day pool practice. All of the teams took advantage of the pool practice day. The LBCC students helped at all of these events.

In May, twelve ITEST SCOUT teams took part in the Southern California regional competition. (All total there were 13 SCOUT and 6 RANGER class teams. Many of the ITEST schools had two or three teams, and there was one non-ITEST SCOUT team.) This was the first year that any SCOUT teams participated in this regional event. The teams brought a lot of school spirit, in many cases wearing school t-shirts or t-shirts that had been made specifically to celebrate their ROV team.

### Successes/Program Strengths

- Recruitment of teachers and students was easy after securing administrative buy-in for the program.
- Pairing LBCC students from the electrical program with teachers was a positive experience for the college students, middle school students, and teachers. (Electrical tasks are often the most difficult for teachers lacking a technical background so this pairing was particularly appropriate.) This experience was enjoyable for the LBCC students, helped cement their own knowledge, and also acted as a valuable resume builder for them. The LBCC students remarked on the relationships that they had built with the middle school students with comments such as "The kids' reaction to accomplishing a goal, just seeing their faces brighten up, it was all worth it." This pairing also worked well for supporting the teachers. It was a boon for the regional coordinator since it removed some of the time burden and allowed the program to reach more schools than he would have been able to support on his own. Anecdotal reports indicate that it was a positive experience for the middle school students as well; the LBCC students served as role models and examples of postsecondary education options in the field. The fact that some of the LBCC students were of minority background may have helped them connect well to the minority middle school students.

### Challenges

- The time commitment necessary to obtain approval from both school Boards was a burden. However, since the approval has been obtained, next year's program should be much less time consuming to start up.
- One of the schools had a difficult adult volunteer who was asked to leave halfway through the program.

- Some of the teams were frustrated with the time lag between the last competition event and the announcement of winners and awarding of prizes – the time it took to tally the scores. The regional coordinator is considering adding some sort of event to keep the participants entertained during this period.
- Managing the growth of the competition is a challenge. The regional coordinator is considering expanding it to a two-day event. However, this creates logistical challenges for teams that have to travel to the event.
- This model of implementation required pulling five of the most active LBCC Explorer class ROV team members away from working on their own ROV. While the college students did not complain about the additional time commitment, it did take longer to complete their own ROV.
- One LBCC student said his challenge was the short attention span of the students and keeping them on track. Another said that his challenge was the teacher not taking his advice and having to correct the teacher's mistakes later.

### Changes for Next Year

- The regional coordinator plans to encourage the teams to make much smaller ROV's. He noticed that some teams created large structures which didn't perform well with the small SCOUT class motors. He will suggest that they limit themselves to structures that would fit inside an eight inch cube. Some of the vehicles this year were up to two feet wide.
- As noted above, the regional coordinator is considering different ways to manage the growth of the competition with the size limitations of the pool used as the competition venue. One option is to expand into a two-day event.
- Now that administrative approval has already been secured, Scott plans to start the program earlier in the school year.

# NEW ENGLAND

## Unique Features of Regional Implementation

- Worked primarily with two after-school programs: Citizen's Program and Boys and Girls Club of Fall River
- Assigned Bristol Community College (BCC) engineering students, many of whom were also on the BCC Explorer class ROV team, to teach two 10-week sessions at the after school programs
- Held two separate 10-week sessions culminating in two mini competitions, one in the fall and one in the spring
- Planning a three-day teacher workshop in July

## Staffing

The regional coordinator for New England is Meghan Abella-Bowen, faculty in the Division of Mathematics, Science, and Engineering at Bristol Community College (BCC). ITEST implementation in the New England region involved the participation of 12 volunteer BCC engineering students, four of whom were also on the BCC Explorer class ROV team. The students were responsible for developing a 10-week curriculum and delivering it to middle school students participating in after school clubs. They also helped with teacher workshops. The BCC students were purely volunteers and did not receive any salary or course credit for their time. At the end of the school year, all of these students received the Presidential Volunteer Service Award, two at the Silver Level and the remainder at the Bronze Level.[11]

## Implementation Overview

In New England, the ITEST implementation took part in two separate phases: fall and spring. Prior to receiving the ITEST grant, Meghan had been approached by the New Bedford Schools' Citizens Program, an after school program serving low income and minority students. This existing relationship facilitated a quick ramp-up of the program in the fall. Seven of the BCC engineering students participated in the fall program, developing and delivering a 10-week curriculum on how to build an ROV for two middle schools in the Citizens Program. Four of the BCC students taught at one school, and three taught at the other. Each school had 15 middle school students divided into two teams. The fall session culminated in a mini ROV competition in January. There were some breakdowns in communication, and the schools did not receive all of the information about the logistics of the competition; therefore, only one team made it to the pool to participate in the competition.

[11] For further information about the Presidential Volunteer Service Award, please see: http://www.presidentialserviceawards.gov/tg/pvsainfo/dspAboutAwards.cfm

In the fall, Meghan also started to recruit teachers for the spring session, to be launched with a January workshop. She emailed teachers in all of the local schools, starting with the science chairs or the top administrators in the district. Another source of outreach was through her contacts at Lockheed Martin. She emailed them, and they forwarded the information to their network of teachers. She also contacted education collaborative and the state science teachers' listserv. One challenge was that the technology programs have been removed from the schools in Massachusetts, and many of the science teachers didn't immediately see how the ROV program related to their courses. Meghan offered to come present at department meetings, but no one took her up on the offer so most of her recruitment was through email and phone calls.

Another recruiting activity that took place in the fall (September) focused on students. At the Working Waterfront Festival in New Bedford, Meghan and the BCC ROV team had a booth. They set up a tank with little ROV's and let children use the ROV to pick something up from the bottom of the tank. The children won a sticker for successfully retrieving the item. When students and parents were interested in learning how to build an ROV themselves, she encouraged them to talk to their teacher – and for the teacher to attend the upcoming workshop.

In January, Meghan held an all-day teacher workshop for both middle school and high school teachers. (The high school teachers were paid out of a separate grant.) The middle school teachers included several teaching at all-girls schools that plan to participate in the ROV program next year.

In February, she invited the local schools, YMCA, Boys and Girls Clubs, Boy Scouts and Girl Scouts to an ROV in a Bag workshop. Partners from Lockheed Martin came and worked with the students, and the BCC engineering students helped as well. Twenty-two middle school students participated, including eight from the Boys and Girls Club of Fall River.

After this workshop, Meghan was approached by the Boys and Girls Club of Fall River to run the 10 week program again. She found five different BCC engineering students who started in the first week of March, implementing the same curriculum from the fall program. This program was different because the Boys and Girls Club had their own pool so each week's activities could include pool time for the ROV. The culminating event was another mini ROV competition, held in June. Three teams of students participated.

In July, Meghan is planning a three-day ROV teacher workshop. She found that the one-day workshop was not sufficient for middle school teachers because they lacked the necessary technical background. In the July workshop, the participants will start from scratch (e.g., introduction to soldering) and will leave with a toolbox including their own soldering iron. The goal is for them to feel comfortable with a basic electrical circuit.

### Successes/Program Strengths

- Using college students to work with the middle school students was a strength of the program. Please see the "Successes" section of the Southern California description for a discussion of the

positive aspects of this implementation method. While the students in this case were actively teaching the material, rather than acting as technical support, the same positive effects of their involvement apply here.

- The regional coordinator's prior relationship with the school system and the Citizens Program allowed for a quick ramp-up of the ITEST program, which enabled the region to offer the fall session. The two-session format was unique among the regions.

### Challenges

- Outreach to the middle school teachers was a challenge. They had difficulty making the connection between the science in their classroom and the technical aspects of the ROV program. Next year, the regional coordinator plans to bring on a former middle school teacher who is familiar with the MATE ROV program and ask her to talk to the local middle school teachers about how to integrate this activity into their classrooms.
- Determining the best timing for each of the workshops was an additional challenge.

### Changes for Next Year

- There is a lot of ROV activity in Southeastern Massachusetts, and one of the future challenges and opportunities is learning how to best collaborate with the other programs. There are two ROV summer camps for gifted and talented students, and the Massachusetts Maritime Academy will be running three week-long workshops for students. A colleague of Meghan's is going to be on an expedition from July to September and is planning to blog about her work as an ROV technician. Meghan would like to find a way to integrate the blog into her teacher workshops or share it with teachers in a way that they could use it with their students.
- As mentioned above, the regional coordinator plans to work with a former middle school teacher to help with teacher outreach.

## RATING OF THE MATE CENTER'S SUPPORT

Overall, the coordinators were pleased with the support provided by the MATE Center for grant implementation. In general, they found the instructional materials helpful and stated that it was useful to have the grant implementation money provided up front. They indicated that students found the PDF document about careers with wage information very interesting.

In the future, they would like to have additional curriculum materials, both for performing the technical tasks (e.g., soldering), and for showing how specific classroom subjects (i.e., physics) are tied to the ROV project. Another suggestion was to produce a video for use in student outreach or class presentations that would show the beginning student the SCOUT class vehicles and how the students could progress through the different competition classes, then show previous competitors who work in the field – demonstrating what they do and how much money these professions pay.

## SUMMER INSTITUTE

The ITEST Summer Institute is planned for July 12th – 18th. The goals of the program are to provide the participants with the knowledge to become resources for the ROV programs in their regions. This includes not only technical skills but also information about marine STEM careers. Please see the MATE Center annual report and addenda for detailed information about the plans for the Institute, including speaker biographies and the daily agenda.

The main Summer Institute activities covered by the timeframe of this evaluation report consist of participant outreach and recruiting and planning the content and logistics of the Institute. The MATE Center has many years of experience running Summer Institutes for the advanced technical skills so planning the ITEST beginner-level Summer Institute went smoothly.

Recruiting participants was more challenging than expected, given that the program covered all expenses for travel and instruction and provided a stipend as well. Outreach was first conducted in the four regions that implemented the grant in the 2009-2010 year, through contact by the regional coordinator and personal emails and phone calls by the Summer Institute coordinator. This resulted in eight applicants being accepted. After May 1st, registration was opened to all regions, and an additional six applicants were accepted.

It is not entirely clear why recruitment was so challenging. Possible explanations include the following:

- Outreach may have begun too late in the school year. Next year, outreach will begin sooner.
- The current economic climate has made teacher contracts more tenuous. If the teachers are unsure if they have a contract for the following year, they may be less likely to apply for the Institute. (Note: This possible explanation was offered by an ITEST regional coordinator.)
- Outreach and connections to the middle school principals could be strengthened.
- Many teachers who initially expressed interest but later declined cited family vacations as the reason, especially the fact that the Institute covers a weekend. The MATE Center does not plan to shorten the Institute.

Teachers who could not attend offered explanations such as the following:

> *I was excited to say "yes". I just recently was forwarded the application to fill out and realized it was not just Monday - Friday but through Sunday. I have a wedding that I must attend in Ventura on the 17th.*
>
> *I am leaving the country with students on Friday for Space Camp in Turkey as part of a Global Friendship through Space Education program we participated in this year.*
>
> *The students at our school loved the program are already excited about next year's competition. Again, thank you for your patience. We are having a big turnover of*

*science teachers at our school this year so I don't think we will send someone this summer.*

*I'm on a two-year cycle with my curriculum so the next time it would make sense to do a ROV program would not be until the 2011 - 2012 school year. Perhaps we could remain in touch..and I can still come to any trainings that are offered?*

Teachers who were planning to attend seemed very excited about the Summer Institute and offered responses such as the following:

*Yes, we are incredibly interested in sending a staff member. We have been working with the project all year and would love to attend. We are working on the application now. Please hold a spot for me.*

*I'm so excited I'm about to pop!*

*OH HECK YEAH!*

Analysis of the ITEST Summer Institute will be included in the next evaluation report.

## OBJECTIVE TWO

*Objective 2: Increase ocean STEM career awareness and present trajectories to those careers for middle and high school audiences.*

In the first grant year, project staff reviewed existing middle school resources (both within the MATE Center and external resources) and met with advisors and middle school teachers in order to understand how to best modify the existing MATE Center career resources, the www.OceanCareers.com website and the *Exploring Ocean Careers* online course, to meet the needs of the middle school audience. Special attention was paid to strategies for making the resources engaging for underrepresented students and their parents. Progress on this objective is several months behind schedule due to staff turnover. The work has been reallocated to other staff, and the updates to the resources are planned to take place in the fall of 2010, with dissemination in the spring of 2011.

## OBJECTIVE THREE

*Objective 3: Build a cyberlearning center to a) foster collaboration and increase communication among students, educators, parents, and working professionals; and b) improve access to STEM instructional resources.*

Development of the initial iteration of ROVER, the cyberlearning center, is almost complete. The website is scheduled to launch in September of 2010, to coincide with the start of the school year. A pre-launch version of the website is available for viewing at www.rover.itest.us/main. For details of the website development, please see the MATE Center's ITEST Annual Report.

Implementation, usage, and effectiveness of the ROVER website will be assessed in the next evaluation report.

## OBJECTIVE FOUR

*Objective 4: Evaluate and track project participants to determine the impact on a) students' STEM knowledge, skill development, and inclination to pursue STEM education and careers; and b) teachers' confidence in facilitating STEM learning experiences and delivering career information.*

In the first year of the grant, multiple interview and survey protocols were developed and administered to a variety of project stakeholders. Records review and observations of meetings and competitions also informed the evaluation. Analysis of the multiple data sources provided preliminary findings on the project's movement towards the expected outcomes. This report demonstrates the progress made towards Objective Four.

## ADDITIONAL GRANT ACTIVITIES

In addition to the grant implementation activities that fit within each objective, the MATE Center also performed several other implementation tasks in support of the project as a whole. These included a Regional Coordinators Meeting held in Biloxi in conjunction with the MTS/Institute for Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) Oceans Conference on October 26th, 2009. This meeting kicked off the ITEST grant implementation.

Additionally, the MATE Center held an ITEST Curriculum and Cultural Advisory Committee meeting on March 15th and 16th, 2010 in Monterey, California. At this meeting, the advisory committee members provided insight into the challenges that middle school teachers face, strategies for reaching out to diverse audiences, and suggestions for an extensive list of books and resources to inform the background research for this project.

The project also conducted a variety of outreach activities, including workshops and presentations to students, teachers, and industry professionals. Please see the Annual Report for a complete list.

# PRELIMINARY FINDINGS

This chapter reviews the project strategies and associated research questions. Evaluation results from all applicable data sources are summarized under each research question. This report primarily focuses on project strategies one (professional development) and two (developing the SCOUT class ROV competition). Implementation of the other strategies is not yet complete. Preliminary findings of evaluation results by gender and ethnicity are included at the end of the chapter.

## Project Strategy 1: Provide Professional Development, including Workshops and Summer Institutes

### Research Question 1.1. Did the teachers gain confidence facilitating STEM learning experiences through the workshops?

Pre and post workshop surveys demonstrate that the participants gained confidence facilitating STEM learning experiences.

In the pre-workshop surveys, only one about one-quarter of the respondents (28%, N=32), indicated that they were very comfortable facilitating STEM learning experiences. Close to half (45%) stated that they had concerns about mentoring students in designing and building an ROV. Half of the teachers (50%) indicated that they were concerned that they may not have the necessary technical skills and expertise. According to the interviews with the regional coordinators, as a whole, the middle school teachers had minimal technical skills when they started the program so it appears that this concern was valid.

In the post-workshop surveys (N=30), all of the respondents stated that they felt more confident (48% “much more confident” and 52% “somewhat more confident”) facilitating STEM learning experiences for students. When asked if the training addressed their concerns about designing and building an ROV, 83 percent indicated that they felt less concerned. Overall, 90 percent of the respondents rated the usefulness of the training as “excellent”, and 10 percent gave it a rating of “good”.

### Research Question 1.2. What was the impact of the workshops on the teachers' decision to participate in the ROV competition?

Post workshop surveys indicate that the workshops helped affirm the teachers' decision to participate in the program. After the training, 72 percent of the respondents marked that they intended to mentor a team. (The other 28 percent marked "maybe"). Eighty-nine percent indicated that as a result of the training, they felt more committed to participating in the competition; seven percent stated that their commitment level was unchanged, and one respondent was less committed.

### Research Question 1.3. Did attendance at the Summer Institutes lead to greater awareness/understanding of ocean STEM careers?

The ITEST Summer Institute took place after the timeframe covered by this report. Initial feedback on the Institute was collected immediately upon completion of the program, and the participants will be contacted again in six months to inquire about the application of what they learned. Results of these surveys will be included in the next evaluation report.

# Project Strategy 2: Support the Development of the SCOUT (Entry Level) ROV Class[12]

**Research Question(s) 2.1. To what extent did participating in the ROV program lead to an increase in the students' interest in STEM and STEM careers? Did educators and parents observe an increase in the students' interest in STEM and STEM careers as a result of the program? An increase in the students' STEM knowledge and skills and SCANS skills?**

**Increased Awareness of and Interest in STEM Careers:** After building their ROV, 97 percent of the students (N=98)[13] indicated that they knew more about careers in marine science, technology, and engineering. Indeed, 50 percent marked that they knew "a lot more". Seventy-one percent (71%) stated that their ROV project made them more interested in a marine career. (Overall, 46 percent of the students were interested in having a career in marine science, technology, or engineering; 47 percent were not sure, and 7 percent were not interested in a career in this field.)

Among the teachers/mentors who completed post-competition surveys (N=8), all of the respondents (100%) indicated that they had observed that their students were more interested in pursuing a STEM career. While this is a small sample size, the teacher/mentor survey results are in line with the results of prior years' surveys of teachers/mentors of Ranger and Explorer class teams.

**Increased Interest in STEM:** Three quarters of the students (75%) stated that their ROV project made them want to learn more about ocean science, technology, and engineering. Students indicated that their ROV projects increased their desire to take courses in science (72%), computer science (48%), math (39%), engineering (19%), and other hands-on classes or club activities like robotics, electronics and shop courses (65%). Additionally, 65 percent of the students wanted to learn more about undersea volcanoes, including how ROV's are used.

In the post-competition survey, all of the teachers/mentors (100%) indicated that their students were more interested in learning about science, technology, engineering and math. This follows patterns of prior surveys of teachers/mentors.

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[12] In the proposal, this project strategy was stated as "Provide student workshops and ROV STEM curriculum". After the first year of implementing the grant, it became clear that the wording of this strategy and the associated research questions needed to be broadened to "support the development of the SCOUT (Entry Level) ROV Class."

[13] All student survey results presented in this report chapter are based on a total of 98 completed surveys.

Parents concurred with the other sources reporting increased student interest in STEM. Ninety-five percent (95%) of the parents surveyed (N=80)[14] stated that building an ROV has made their child more interested in science, technology, engineering or math. Open-ended comments from the parents include the following:

> *More interest in hydrodynamics*
>
> *More interested in the ROV industry*
>
> *Interest in aquatic science*
>
> *Has had a slight shift from loving astrophysics to also loving marine engineering*

**Increased STEM Knowledge and Skills:** Most students entered with no knowledge about ROV's. Over half of the students (52%) did not know what an ROV was before entering this program, and for over three quarters of the students (78%), this was their first time building an ROV. One indication of increased STEM knowledge is that before beginning their research for the competition, only 9 percent of the students indicated that they knew "a lot" about undersea volcanoes. After completing their research, 41 percent marked that they knew "a lot". Students also gained research skills as part of the competition. Fifty percent used the Internet to conduct research, including websites for organizations including NOAA, Hawaii Center for Volcanology, and the University of Hawaii School of Ocean, Earth Science and Technology. Additionally, 22 percent interviewed teachers or parents, and 17 percent used print resources, such as journals and newspapers.

Parents reported that building an ROV contributed to improving their child's grades in science (72%), math (55%), computers (61%), and engineering/robotics (76%).[15]

[14] All of the parent survey results are based on 80 completed surveys.

[15] Percentages are calculated among students studying each topic.

# ROV Program Testimonials

## *Parents*

*This program kept my highly disillusioned, turned-off, gifted child in school.*

*My daughter…thoroughly enjoyed the experience, and it inspired her classmates' interest in robotics and design. I loved watching her grow in this new direction. At the competition, she watched other students intently, seeking new ideas for designs. Thanks so much to organizers and volunteers for making this possible.*

*This has been the most fantastic experience. The kids have learned so much through this process without thinking of it as 'work'. I hope this program continues for many years and that my younger son can participate too.*

## *Faculty/Mentors*

*All students took something valuable away from the experience.*

*The kids learned a lot about teamwork.*

*This was our school's first year participating. At the competition…I thought they performed very well, and I was proud of their willingness to adapt and desire to learn. We used their scores on the tasks and looked at their strengths and areas for growth for next year. They want to get started the minute the tasks are out next November!*

Among the teachers/mentors who completed post-competition surveys, all of the respondents reported that they observed improvements in their students' STEM knowledge and skills.

**Increased SCANS skills:** In the post-competition surveys, all of the teachers/mentors mentioned that they observed increases in their students' skills in team building, problem solving, and/or critical thinking.

When parents were asked what changes they have seen in their child as a result of their involvement in the ROV project, 70 percent reported that their children were better able to work with others; 70 percent indicated that their child's self confidence had improved, and 28 percent marked that their child was better organized. In the open-ended comments, other changes that parents observed in their children included the following:

> *Increased passion for building, mechanics, out of box thinking, outlet for creativity in thinking of mechanical solutions.*
>
> *Social skills, leadership, team building skills, collaboration – very positive experience.*
>
> *Remarkable improvement in leadership and speaking skills.*
>
> *More persistent when things don't work right away.*
>
> *Imagination has improved!*
>
> *Great to see an interest in something other than videos. Loves the hands on problem solving.*
>
> *Working on a team was an excellent experience. Having a task that was compelling was very important.*
>
> *More involved in school, more social, happier.*
>
> *Excited to go to school on days when the ROV club met.*

Overall, parents rated their children's experience building and competing with an ROV extremely positively. Seventy percent rated it as excellent, 26 percent gave a rating of good, 3 percent marked fair, and 1 percent rated it as poor.

## 2.2. Did participating in the workshops (or observing the competitions) lead to an increase in the parents' support of their children's interest in STEM careers?

Eighty-one percent of the parents surveyed indicated that participation in the ROV program changed how they envisioned their child's future, making it easier to picture their child with a STEM career. Eleven percent marked that the program participation did not affect how they picture their child's future, and 8 percent were not sure.

## 2.3. Were the curriculum materials and workshops at the appropriate level for a middle school audience?

**Curriculum materials:** Due to the extremely quick ramp-up time of this year's grant implementation, there was no time to design a curriculum specific to this program. Rather, the MATE Center sent a collection of previously developed instructional and support materials to the regional coordinators. The regional coordinators selected the materials that best fit into their teacher, student, and mentor workshops and class presentations. Anecdotal reports from the regional coordinators were that the materials were useful. In the future, they would appreciate having materials specifically designed for this program, including items that would help show teachers how this program fits into their classroom topics (e.g. how ROV's apply to physics, etc.) The MATE Center has plans to develop support materials specifically for this program. Once the new materials are released, they will be evaluated for appropriateness for the middle school audience.

**Workshops:** Anecdotal reports from regional coordinators, faculty, and parents indicate that the workshops targeting a broad audience (students, teachers/mentors, and parents) were at the appropriate level for the middle school audience, and that the participants were very engaged. It appears that the middle school teachers generally had minimal technical skills, and the regional coordinators struggled a bit with the teacher workshops: how to provide enough information that the teachers would have the skills to succeed without overwhelming them. The regional coordinators responded to this challenge with different approaches: most offered multiple workshops throughout the program duration. The New England regional is planning a three-day workshop in July, with the goal of taking teachers who have no technical skills and bringing them to the point that they are comfortable wiring a basic controller. Another professional development opportunity for these teachers is the MATE Center's week-long Summer Institute.

This evaluation question will be investigated more rigorously in the upcoming year.

### 2.4. What was the impact of the workshops and other support on the teams' ability to build an ROV and participate in the regional competitions?

As stated above, 89 percent of the teachers indicated that as a result of the workshops, they felt more committed to participating in the competition. The biggest indicator that the regions successfully supported the teams was the increase in the number of SCOUT class teams participating in regional competitions and other SCOUT class culminating events.

## Project Strategy 3: Modify Career Guidance Resources to Better Suit Middle & High School Students

### 3.1. Has the *Exploring Ocean Careers* course and web site been modified so that the appeal, information and delivery are appropriate for the middle and high school audience?

The Exploring Ocean Careers course is in the process of being updated and modified. It will be evaluated once the revised website is launched in the 2010-2011 project year.

### 3.2. Did students, educators and parents use the career guidance tools? Did their awareness of ocean STEM careers increase as a result of these tools?

The career guidance tools are in the process of being updated. It is unclear to what extent the current tools are being used by the ITEST audience. Nonetheless, there are indications that students' awareness of STEM careers has increased through their participation in the program. As stated above, after building their ROV, 97 percent of the students (N=98) indicated that they knew more about careers in marine science, technology, and engineering. The usage and effectiveness of the updated career guidance tools will be evaluated once they are released.

# Project Strategy 4: Build ROVER, a Cyberlearning Center

## 4.1. Has ROVER increased access to career and instructional resources? Increased use of the resources?

ROVER will be evaluated after it is launched in September 2010.

## 4.2. To what extent were the website users satisfied with the ease-of-use of the website? With the materials available through the website?

ROVER will be evaluated after it is launched in September 2010.

## 4.3. Has ROVER increased communication between students, educators, industry professionals, and parents?

ROVER will be evaluated after it is launched in September 2010.

## 4.4. Did the availability of ROVER affect the teams' ability to build an ROV and participate in the regional competitions?

ROVER will be evaluated after it is launched in September 2010.

# Preliminary Findings by Gender & Ethnicity

In the ITEST proposal, the evaluation proposed exploring the findings by gender, ethnicity, and socio-economic status. Socio-economic status has proved difficult to collect, considering the large number of schools and clubs involved and their varying privacy concerns. We are considering different possible proxies for this demographic factor. However, preliminary analysis by gender and ethnicity was possible, based on self-reported demographics in the student survey. According to the demographic data in the surveys (N=98), the students were about three-quarters male (74%), and slightly more than half were of minority backgrounds (53%). [16]

The results by gender and ethnicity (minority status) are presented below. [17] The analysis focuses on the following topics:

- Awareness of STEM careers
- Interest in STEM careers
- Interest in STEM topics
- STEM knowledge

Positive results were found regardless of gender or ethnicity; however, the strongest gains were among white students and male students. This is a strong area of concern for the PI, and steps are being taken to improve both the recruitment of underrepresented students and the impact that the program has on them.

Prior to the ITEST grant, the MATE Center conducted a study on effective strategies for recruiting underrepresented college students for a marine STEM internship program. The study found that the most effective outreach had the following characteristics:

- Conducted by personnel of diverse backgrounds,
- Used recruitment materials depicting students of diverse backgrounds,
- Offered a contact person for the project, rather than impersonal project contact information, and
- Provided frequently asked questions responding to the parents' concerns.

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**16** As noted in the methodology section, student surveys were not collected from all of the regions; thus, the demographics reported here do not match the overall demographics reported elsewhere.

**17** The sample size of participant surveys from each ethnicity was not large enough to do analysis by individual ethnicity. Instead, all non-white respondents were coded as "minority", and results were analyzed by this "minority status" variable.

While this ITEST project targets a younger age range than the college students in the study, it is likely that many of these lessons apply to the ITEST program as well. The ITEST project will attempt to apply these lessons in a more thoughtful way in year two of the grant, starting by sharing this information with the regional coordinators at the regional coordinators meeting scheduled for September of 2010. As noted in the first chapter of this report, the regions have a variety of implementation methods for the grant; however, within this variety, it should still be possible to incorporate these lessons.

The project has made efforts to include the participation of teachers, college students, staff, and competition judges (industry professionals) of diverse backgrounds who can serve as role models for the middle school students. In the second year of the grant, demographic data will be collected on these stakeholders.

The project has also turned to their Curriculum and Cultural Advisory Committee for advice on this topic. In particular, the committee stressed the importance of reaching out to middle school parents in addition to students. As stated in the ITEST Annual Report, the committee suggested addressing questions such as the following: "Will my family accept this? Can I do this with my family? Will I be able to support my family? I want to live the good life: will an ocean career give me that?" In year two, the project plans to include this information in the updated career information resources.

One of the goals of the project is to help determine the most effective strategies for engaging youth of diverse backgrounds. Future evaluations will track the implementation of these strategies to reach out to underrepresented students, the effectiveness of these strategies in increasing the participation of these students, and the differential impacts on student outcomes.

## Results by Gender

Overall, positive results were found in both male and female students: increased awareness of and interest in STEM careers, increased interest in studying STEM topics, and increased STEM knowledge. In general, the ROV program appeared to generate stronger gains in the boys than the girls.

**Awareness of STEM Careers:** Prior to participation in the ROV program, the level of awareness about careers in marine science, technology and engineering was similar between boys and girls. Eleven percent of the boys and twelve percent of the girls reported that they knew "a lot" about these careers. Likewise, *growth* in career awareness was similar between the genders, though boys reported slightly larger gains. For example, all of the boys (100%) reported that they knew more about marine careers after the program, compared to 92 percent of the girls.

**Interest in STEM Careers:** The male students were more interested in pursuing a career in marine science, technology, or engineering than the female students (male: 51%; female: 33%). Interest in these careers grew due to the ROV program for both males and females, though this effect was stronger for the boys (male: 75% were more interested; female: 58%).

**Interest in STEM Topics:** The ROV program resulted in increased interest in learning about STEM topics for both the male and female students; however, these effects were stronger for the male students in most topics. The students reported that the ROV project made them want to learn more about ocean science (male: 77%; female 65%). They also reported that the ROV project increased their desire to take the following courses:

- Math (male: 46%; female: 20%)
- Science (male 75%; female: 68%)
- Computer Science (male: 56%: female: 24%)
- Engineering (male: 22%; female: 8%)
- Hands-on courses or clubs (male: 71%; female: 48%)

Female students were slightly more likely than the male students to indicate that they want to learn more about undersea volcanoes (male: 65%; female: 69%).

**STEM Knowledge:** One indicator of STEM knowledge was the self-reports of the level of knowledge of undersea volcanoes. Student knowledge about undersea volcanoes increased in both male and female students. Before the program, only 10 percent of males and 8 percent of females indicated that they knew "a lot" about undersea volcanoes. After the program, 45 percent of males and 31 percent of females reported that they knew "a lot". Again, this result was stronger in the males.

## Results by Minority Status

Overall, positive results were found in both the white and minority students: increased awareness of and interest in STEM careers, increased interest in studying STEM topics, and increased STEM knowledge. In general, the ROV program appeared to generate stronger gains in the white students; however, minority students reported stronger desire to take courses in math and engineering.

**Awareness of STEM Careers:** Prior to participation in the ROV program, the level of awareness about careers in marine science, technology and engineering was similar, regardless of ethnicity. Eleven percent of the white students and twelve percent of the minority students reported that they knew "a lot" about these careers. Likewise, *growth* in career awareness was similar, though white students reported slightly larger gains. For example, all of the white students (100%) reported that they knew more about marine careers after the program, compared to 94 percent of the minority students.

**Interest in STEM Careers:** The white students were more interested in pursuing a career in marine science, technology, or engineering than the minority students (white: 52%; minority: 41%). Interest in these careers grew due to the ROV program for both white and minority students, though this effect was stronger for the white students (white: 87% were more interested; minority: 55%).

**Interest in STEM Topics:** The ROV program resulted in increased interest in learning about STEM topics for both white and minority students. These effects were stronger for the white students in most topics. However, minority students were more likely to state that the ROV program increased their desire to take courses in math and engineering, and their desire to take computer science courses was equal to that of the white students.

The students reported that the ROV project made them want to learn more about ocean science (white: 85%; minority 65%). They also reported that the ROV project increased their desire to take the following courses:

- Math (white: 37%; minority: 41%)
- Science (white 85%; minority: 63%)
- Computer Science (white: 48%: minority: 49%)
- Engineering (white: 9%; minority: 29%)
- Hands-on courses or clubs (white: 74%; minority: 59%)

White students were more likely than the minority students to indicate that they want to learn more about undersea volcanoes (white: 73%; minority: 52%).

**STEM Knowledge:** One indicator of STEM knowledge was the self-reported level of knowledge about undersea volcanoes. Student knowledge about undersea volcanoes increased in both white and minority students. Before the program, only 7 percent of the white students and 13 percent of the minority students indicated that they knew "a lot" about undersea volcanoes. After the program, 45 percent of the white students and 35 percent of the minority students reported that they knew "a lot". Again, this result was stronger in the white students.

# CONCLUSIONS

Overall, the MATE Center successfully implemented the first nine months of ITEST grant activities, delivering professional development workshops and supporting the expansion of the SCOUT class ROV competition among the middle school audience. Prior to the ITEST grant, the MATE Center had a robust ROV competition network among high schools, community colleges and universities. The missing link in the pipeline was the middle schools.

Research shows that middle school is the time when many students become disengaged with school in general and with STEM subject matter. Results from this evaluation suggest that the MATE Center has achieved their goal of offering a hands-on, engaging activity for students that helps grow their interest in school and in STEM. This is especially important in school districts that have removed technology and shop classes due to budget constraints, such as those in Massachusetts. Comments from parents were extremely encouraging in this regard. As one parent in the Pacific Northwest wrote, “this program kept my highly disillusioned, turned-off, gifted child in school.” Other parents noted that their children were “excited to go to school on days that when the ROV club met” and “more involved in school”.

In addition to increasing engagement in school, it appears that the ROV program successfully contributed to gains in student awareness of marine STEM careers and interest in pursuing a marine STEM career, increased interest in learning more about STEM topics, and improved STEM knowledge and skills and SCANS skills.

One of the goals of the evaluation is to examine differential impacts of the grant implementation strategies on underrepresented populations. While socio-economic status was not available, this year’s evaluation included some preliminary analysis by gender and minority status. Gains were seen in all of the expected outcomes, regardless of student gender or minority status. However, male students and white students showed stronger gains than female students or minority students in most areas. This finding is not unexpected; in fact, it is consistent with other research on student interest in STEM.

The MATE Center placed a strong emphasis on reaching out to underrepresented populations in the first year of the grant. This is a topic of longstanding efforts on behalf of the Center. For instance, through other funding sources, the Center has studied recruitment of diverse students to STEM internship opportunities. The ITEST PI and regional coordinators expressed their views that reaching out to the diverse audiences is an area that will receive continual attention throughout the grant. Future evaluations will monitor both the effectiveness of the recruitment strategies and the differential outcomes.

# APPENDIX: DETAILED EVALUATION PLAN AND PROTOCOLS

The appendix includes the following items:

- Detailed evaluation plan
- Student post-competition survey protocol
- Faculty/mentor pre-post workshop survey protocol
- Faculty/mentor post-competition survey protocol
- Parent/guardian post-competition survey protocol
- Faculty/mentor follow-up survey protocol
- Regional coordinator interview protocol

## EVALUATION PLAN

This section provides additional detail on Objective Four: Evaluate and track project participants to determine the impact on a) students' STEM knowledge, skill development, and inclination to pursue STEM education and careers; and b) teachers' confidence in facilitating STEM learning experiences and delivering career information.

### Research Questions and Evaluation Measures

The relationship between MATE's project strategies and the related evaluation research questions, the outcomes that MATE hopes to achieve, and key evaluation data sources is delineated in the evaluation design matrix shown below as Table 1.

The evaluation will collect a wide array of complementary qualitative and quantitative data, wherever possible bringing multiple sources of information to bear on evaluation questions. This "triangulation" of data sources will help to strengthen the validity of evaluation inferences and conclusions. Table 2 provides a more detailed summary of the data sources and instruments to be employed by the evaluation. Table 3 is an overview of the evaluation schedule. It shows the connection between the timing of the evaluation activities the timing of the corresponding project activities.

**Table 1: Project Strategies, Research Questions, Expected Outcomes and Key Data Sources**

| Project Strategy | Research Questions | Expected Outcomes | Key Data Sources[1] |
|---|---|---|---|
| 1. Provide professional development: workshops and Summer Institutes | 1.1. Did the teachers gain confidence facilitating STEM learning experiences through the workshops? | 1.1. Increased confidence among teachers in facilitating STEM learning experiences after attending workshops. | 1.1. Pre and post workshop surveys of teachers; post-competition surveys of teachers; interviews of workshop facilitators, regional coordinators, and project PI's. |
| | 1.2. What was the impact of the workshops on the teachers' decision to participate in the ROV competition? | 1.2. Increased levels of teacher commitment to lead a student team after participating in the workshops. Increased number of SCOUT level teams registering and participating in regional competitions. | 1.2. Pre and post workshop surveys of teachers; post-competition surveys of teachers; interviews of workshop facilitators, regional coordinators, and project PI's. |
| | 1.3. Did attendance at the Summer Institutes lead to greater awareness/understanding of ocean STEM careers? | 1.3. Increased level of teachers' awareness and understanding of ocean STEM careers after attending a Summer Institute. | 1.3. Post-Institute surveys of teachers, post-competition surveys of teachers |

[1] Please note: Additional evaluation strategies/activities that may apply to all of the research questions include the following: review of records, observation of regional competitions, informal interviews with students, parents, teachers, and industry representatives, attendance at staff meetings and NSF NVC committee meetings, and other information gleaned from the NSF ATE grant evaluations.

| Project Strategy | Research Questions | Expected Outcomes | Key Data Sources[2] |
|---|---|---|---|
| 2. Provide student workshops and ROV STEM curriculum | 2.1. To what extent did the workshops lead to an increase in the students' interest in STEM and STEM careers? Did educators and parents observe an increase in the students' interest in STEM and STEM careers as a result of the workshops? An increase in the students' STEM knowledge and skills and SCANS skills? | 2.1. Increased or maintained high level of interest among students in STEM and STEM careers after participating in the workshops. Increased STEM knowledge/skills and SCANS skills among students. | 2.1. Pre and post workshop surveys of students, teachers, and parents; interviews of workshop facilitators, regional coordinators, and project PI's. |
| | 2.2. Did participating in the workshops (or observing the competitions) lead to an increase in the parents' support of their children's interest in STEM careers? | 2.2 Increased or maintained a high level of parental support of their children's interest in STEM careers. | 2.2. Pre and post workshop surveys of parents; post-competition surveys of parents; interviews of workshop facilitators, regional coordinators and project PI's. |
| | 2.3. Were the curriculum materials and workshops at the appropriate level for a middle school audience? | 2.3. Modified and presented workshop curriculum appropriate for the middle school audience. | 2.3. Review of curriculum and workshop materials; interviews of workshop facilitators, regional coordinators, and MATE staff; post workshop surveys of teachers and parents. |
| | 2.4. What was the impact of the workshops on the team's ability to build an ROV and participate in the regional competitions? | 2.4. Maintain a high level of student and teacher recognition of the value of the workshops in enabling teams to reach the regional competition. Increased number of SCOUT class teams registering and participating in the regional competitions. | 2.4. Post competition surveys of students and teachers; interviews with regional coordinators and project PI's. |

[2] Please note: Additional evaluation strategies/activities that may apply to all of the research questions include the following: review of records, observation of regional competitions, informal interviews with students, parents, teachers, and industry representatives, attendance at staff meetings and NSF NVC committee meetings, and other information gleaned from the NSF ATE grant evaluations.

| Project Strategy | Research Questions | Expected Outcomes | Key Data Sources[3] |
|---|---|---|---|
| 3. Modify career guidance resources to better suit middle & high school students | 3.1. Has the *Exploring Ocean Careers* course and web site been modified so that the appeal, information and delivery are appropriate for the middle and high school audience? | 3.1 Increased appeal and delivery of career guidance information to middle and high school students. | 3.1. Review of course and website; interviews with industry mentors, regional coordinators, and project PI's. |
| | 3.2. Did students, educators and parents use the career guidance tools? Did their awareness of ocean STEM careers increase as a result of these tools? | 3.2. Increasing number of website visits, unique visitors, and downloads of resources over the three years of the grant. Increased awareness of ocean stem careers among students, teachers, and parents after using the tools. | 3.2. Website usage statistics; post competition surveys of students, teachers, and parents. |

[3] Please note: Additional evaluation strategies/activities that may apply to all of the research questions include the following: review of records, observation of regional competitions, informal interviews with students, parents, teachers, and industry representatives, attendance at staff meetings and NSF NVC committee meetings, and other information gleaned from the NSF ATE grant evaluations.

| Project Strategy | Research Questions | Expected Outcomes | Key Data Sources[4] |
|---|---|---|---|
| 4. Build ROVER, a cyberlearning center | 4.1. Has ROVER increased access to career and instructional resources? Increased use of the resources? | 4.1. Increasing number of website visits, unique visitors, downloads of resources, and usage of specific website areas, such as discussion boards and the mentor referral service, over the three years of the grant. Increased access to new tools developed specifically for ROVER or resources that were not previously available via the web. | 4.1. Review development and test ROVER website and resources; interview project PI's, regional coordinators, and other MATE staff; review website usage statistics. |
| | 4.2. To what extent were the website users satisfied with the ease-of-use of the website? With the materials available through the website? | 4.2. Maintain high levels of satisfaction with website usability and quality of materials available on ROVER. | 4.2. Pop-up surveys of ROVER website users; post competition surveys of teachers and students; interviews of industry mentors available through ROVER's mentor referral service. |
| | 4.3. Has ROVER increased communication between students, educators, industry professionals, and parents? | 4.3. Increased communication between students, educators, industry professionals, and parents, either on the website itself (i.e., discussion boards), or via contacts made through the website (i.e. the mentor referral service). | 4.3. Pop-up surveys of ROVER website users; interviews of industry mentors available through ROVER, regional coordinators, and project PI's; post competition surveys of students, teachers, and parents; review website usage statistics. |
| | 4.4. Did the availability of ROVER affect the teams' ability to build an ROV and participate in the regional competitions? | 4.4. Increased number of SCOUT teams registering and participating in regional competitions. Maintain a high level of student and teacher recognition of ROVER's value in enabling teams to reach the regional competition. | 4.4. Post competition surveys of students and teachers; interviews of regional coordinators and project PI's. |

[4] Please note: Additional evaluation strategies/activities that may apply to all of the research questions include the following: review of records, observation of regional competitions, informal interviews with students, parents, teachers, and industry representatives, attendance at staff meetings and NSF NVC committee meetings, and other information gleaned from the NSF ATE grant evaluations.

**Table 2: Evaluation Data Sources**

| Data Source | Data Source Details |
|---|---|
| Record Data | Project statistics on student, teacher and parent attendance at workshops, teacher attendance at Summer Institutes, team registration and participation in regional competitions, student demographic characteristics, website usage statistics, etc. |
| Documentary Materials | Workshop curriculum and other materials, career guidance tools, ROVER website and tools, project planning documents, management directives, descriptions of recruitment procedures, ancillary materials, print and website publications including planning guidelines for dissemination, MATE annual reports, etc. |
| Observation | Attendance at project meetings, observation of regional competition(s). |
| Workshop Facilitator Interviews | Telephone and personal interviews with workshop facilitators (4-6 each year), guided by interview protocols, addressing the issues of teacher, student, and parent response to the workshops, effectiveness of curriculum for the middle school audience, STEM skill building, student interest in STEM careers, teacher confidence and commitment to bring a team to the competition, extent of student and teacher learning and obstacles to learning, and related topics. |
| Regional Coordinator Interviews | Telephone and personal interviews with all regional coordinators each year, guided by interview protocols, addressing the issues of student and teacher recruitment and retention, industry partnerships, effectiveness of workshops, curriculum, career guidance tools, and ROVER, MATE support of regional networks, local community strengths and weaknesses, and related topics. |
| MATE PI's and Staff Interviews | Telephone and personal interviews with MATE PI's and staff, guided by interview protocols, addressing the issues of student and teacher recruitment and retention, appropriateness of materials developed for the middle school audience, MATE support of regional competitions, usage and effectiveness of the curriculum, career guidance tools/website and ROVER, and related topics. |
| Industry Mentor Interviews | Telephone interviews will be conducted in year three of the grant with industry mentors participating in the ROVER mentor referral service. Interview topics to include satisfaction with mentor referral service, number of contacts received through the service, types of help requested and provided through the service, extent of time spent on mentoring activities, assessment of the usefulness of the ROVER website and tools, suggestions for improvements, and related topics. |
| Workshop Surveys of Teachers | Pre and post surveys administered to all teacher attendees, addressing issues of teacher confidence facilitating STEM learning experiences, commitment to bringing a team to competition, self-assessment of curriculum mastery, assessment of students' growth in STEM knowledge and skills, SCANS skills, and interest in STEM careers, and related topics. |
| Workshop Surveys of Students | Pre and post surveys administered to all student attendees, addressing issues of interest in STEM careers, self-assessment of curriculum mastery, quality of instruction, and related topics. |

| Data Source | Data Source Details |
|---|---|
| Workshop Surveys of Parents | Brief pre and post surveys administered to all parents attending workshops, asking about their support for their children's interest in STEM and STEM careers and changes that they have observed in their children as a result of their participation in the ROV competition process. |
| Summer Institute Surveys of Teachers | Post surveys administered to all Summer Institute participants at the end of the Institute, addressing issues of quality of instruction and content, increased awareness and understanding of ocean STEM careers, and usefulness of this professional development to their classroom instruction. This will be a modified version of the current post-Institute teacher survey, which has been used for the past five years as part of the MATE ATE evaluation. |
| Post-Competition Surveys of Students | Questionnaires distributed at regional competitions, focusing on topics including the value of the competition and workshops, usage and value of ROVER and the career guidance tools and website, awareness and interest in STEM careers, awards/honors received as a result of competition experience, self-assessment if change in STEM knowledge and skills, interest in participating in future competitions, and related topics. This will be a modified version of the international ROV competition student survey protocol, which has been administered to over 1,500 students over the past five years |
| Post-Competition Surveys of Teachers | Questionnaires distributed at regional competitions, addressing issues of the value of the competition and workshops, usage and value of ROVER and the career guidance tools and website, awareness of STEM careers, self-assessment of change in STEM knowledge, incorporation of competition into course curriculum, interest in participating in future competitions, assessment of change in their students' STEM knowledge/skills, SCANS skills, and interest in STEM careers, and related topics. . This will be a modified version of the international ROV competition teacher survey protocol, which has been administered to over 400 teachers over the past five years. |
| Post-Competition Surveys of Parents | Questionnaires distributed at regional competitions, addressing issues of parental support of their children's interest in STEM and STEM careers, value of the competition, usage and value of ROVER and the career guidance tools and website, and related topics. |
| Surveys of ROVER Website Users | Pop-up surveys will invite ROVER users to rate the usability of the website and the usefulness of the tools available there. |

**Evaluation Schedule**

The evaluators will meet with MATE staff prior to project pre-award startup in order to review project objectives and discuss data collection responsibilities and detailed schedules in light of project implementation plans. Initial development of data collection instruments will begin during this period, and arrangements will be made for the evaluation to receive project documentary materials. These materials will be collected over the life of the project as they become available. Observations will be made as opportunities present themselves for evaluators to be present at relevant meetings and project activities. Record and survey data collection will generally precede the personal and telephone interviews, which will then be used in part to clarify issues emerging from the record and survey data analysis. Informal formative feedback to project staff will be provided on a continuing basis in the form of regular e-mails and telephone consultation supplemented by personal meetings, with more structured memoranda provided on an as-needed basis. Formative reports will be provided at the end of Project Years 1 and 2 and a summative report at the end of Year 3. Table 3 provides a summary overview of the preliminary schedule for these activities. The schedule will be revised and more closely specified after initial consultations with project staff

In addition to project formative and summative reports, the evaluation will provide instruments and protocols that can be utilized by other organizations that replicate the MATE program. The evaluation will also work with MATE staff to identify ways in which they can assess the effectiveness of any actions they may take on the basis of evaluation recommendations and will coordinate evaluation activities with the ITEST Resource Center.

**Table 3: Overview of Preliminary Evaluation Schedule and Corresponding Project Activities[5]**

| Evaluation Activity | Evaluation Schedule | Relevant Project Activity & Timing |
|---|---|---|
| ***Instrumentation*** | | |
| Design protocols for interviews of workshop facilitators, regional coordinators, and project PI's and staff | Fall (Start of Year 1) | NA |
| Design protocols for pre-post workshop surveys of students, teachers, and parents; post-competition surveys of parents. Modify current protocols for post-Institute surveys of teachers; post-competition surveys of students and teachers. | Fall (Start of Year 1) | NA |
| Design protocols for ROVER pop-up surveys | Summer (End of Year 1) | ROVER launched: Summer, Year 1 |
| Design protocol for interviews of industry mentors | Summer (End of Year 2) | Mentor referral service launched: Summer, Year 2 |
| ***Data Collection*** | ***Each Project Year, Unless Otherwise Marked*** | ***Each Project Year, Unless Otherwise Marked*** |
| Professional development workshop surveys | Fall | Professional development workshops: Fall |
| Student workshop surveys | Winter-Spring | Student workshops: Winter-Spring |
| Post-competition surveys | Spring | Regional competitions: Spring |
| Post-Summer Institute surveys | Summer | Summer Institutes: Summer |
| ROVER surveys | Ongoing (Years 2-3) | Rover launched: Summer, End of Year 1 |
| Interview industry mentors | Spring (Year 3 only) | Mentor referral service launched: Summer, End of Year 2 |
| Interview workshop facilitators, regional coordinators and MATE PI's and staff | Spring-Summer | Workshops: Fall-Spring, Regional competitions: Spring |

[5] Please note that the project timeline designates that each project year runs from fall to summer.

| | | |
|---|---|---|
| Documentary materials | Continuous | Careers course and website developed (Years 1-2) and disseminated (Years 2-3); ROVER developed (Year 1), refined and expanded (Years 2-3), etc. |
| Record data | As available | Variety of project activities |
| Project reports | As available | Project reports, as available |
| Observation | As opportunities arise | Regional competitions: Spring; Meeting of regional organizations: Fall |
| ***Reporting*** | | |
| Informal formative feedback | Continuous | -- |
| Formative reports | 90 days after end of Years 1 and 2 | -- |
| Summative report | 90 days after end of Year 3 | -- |

Dear Student:

This survey is being circulated by the Marine Advanced Technology Education (MATE) Center, headquartered at Monterey Peninsula College in Monterey, California. The MATE Center is a national program funded by the National Science Foundation to help prepare students for careers as marine professionals. The information that you provide on this survey is confidential and important to us!

Note: Depending on how you answer particular questions, you may then be taken to a question that appears out of order. Do not be concerned. This is simply the way that the survey is designed to save you time.

Thank you!

### 1. What is your instructor's name and school/team name?

### 2. Is this your first time building an ROV?

- ◯ Yes
- ◯ No

### 3. Did you know what an ROV was before you built one?

- ◯ Yes
- ◯ No

### 4. Before building your ROV, how much did you know about careers in marine science, technology, and engineering?

- ◯ A lot
- ◯ Some
- ◯ A little
- ◯ Nothing

### 5. After building your ROV, do you know more about marine careers? How much more?

- ◯ A lot more
- ◯ Some more
- ◯ A little more
- ◯ No more

### 6. Are you interested in having a career in marine science, technology or engineering?

- ◯ Yes
- ◯ No
- ◯ Not sure

**7. Has your ROV project made you more interested in a marine career? Less interested? Did it not make any difference?**

- ◯ More interested
- ◯ Less interested
- ◯ No difference

**8. What career would you like to have when you finish school?**

**9. Has your ROV project made you want to learn more about ocean science, technology and engineering?**

- ◯ Yes
- ◯ No
- ◯ Not sure

**10. Has your ROV project increased your desire to take any of these courses? (Mark all that apply)**

- ☐ Math
- ☐ Science (I.e., physics, chemistry, biology, earth science, etc.)
- ☐ Computer Science
- ☐ Engineering
- ☐ Hands-on classes or club activities like robotics, electronics, shop courses
- ☐ None

**11. Have you or your school received an award or honor as a result of your ROV project?**

- ◯ No
- ◯ Yes, please describe:

**12. Has your ROV project opened up other education or career opportunities for you (e.g., strengthened college application, scholarship, internship, job offer)?**

- ◯ No
- ◯ Yes, please describe:

This year's competition theme highlighted Loihi, an active undersea volcano. In preparation for the technical report and poster display, you were asked to present information about Loihi, including the processes that created it and/or the research, technologies, and/or people who explore and study it.

**13. <u>Before you began your research for this competition</u>, how much did you know about undersea volcanoes?**

- ◯ A lot
- ◯ Some
- ◯ A little
- ◯ Nothing

**14. <u>After completing your research for this competition</u>, how much do you know now about undersea volcanoes?**

- ◯ A lot
- ◯ Some
- ◯ A little
- ◯ Nothing

**15. Do you want to learn more about undersea volcanoes, including how ROVs are used?**

- ◯ Yes
- ◯ No
- ◯ Not sure

## 16. What resources did you use in your research?

- [ ] Websites (please specify below)
- [ ] Journals, newsletters, and other print publications
- [ ] Interviews with working professionals or employers
- [ ] Teacher or parent
- [ ] Other (please specify)

Some questions about you:

## 17. What is your grade level?

- ◯ Elementary School Kindergarten
- ◯ Elementary School 1st grade
- ◯ Elementary School 2nd grade
- ◯ Elementary School 3rd grade
- ◯ Elementary School 4th grade
- ◯ Elementary School 5th grade
- ◯ Middle School 6th grade
- ◯ Middle School 7th grade
- ◯ Middle School 8th grade
- ◯ High School Freshman
- ◯ High School Sophomore
- ◯ High School Junior
- ◯ High School Senior
- ◯ Community College Year 1
- ◯ Community College Year 2
- ◯ Four-year College or University Freshman
- ◯ Four-year College or University Sophomore
- ◯ Four-year College or University Junior
- ◯ Four-year College or University Senior
- ◯ Graduate School
- ◯ Other (please specify)

## 18. What is your gender?

- ◯ Male
- ◯ Female

## 19. What would you say best describes your ethnicity? (You can check more than one)

- [ ] White
- [ ] African American/Black
- [ ] Hispanic/Latino/a
- [ ] Asian
- [ ] Filipino/a
- [ ] Pacific Islander
- [ ] American Indian or Alaska Native
- [ ] Multiple Ethnicities
- [ ] Other (please specify)

The MATE Center would like to keep in touch to learn more about your future education, career choices, and job positions. If you are willing, please provide us with your name and permanent e-mail and/or snail mail address so that we can contact you in the future. Thanks!

## 20. Contact Information:

| | |
|---|---|
| First name | |
| Last name | |
| E-mail | |
| Mailing address Line 1 | |
| Mailing address Line 2 | |
| City | |
| State | |
| Zip | |
| Current phone number | |
| E-mail or phone number of someone who will always know how to get in touch with you | |

## 21. One easy way for you to keep in touch with the MATE Center – and for MATE to keep in touch with you – is through MATE's alumni web site, "AlumniWeb", at www.marinetech.org/alumni/. We thank you for registering and would appreciate hearing from you over the years as you progress in your education and career!

## THANK YOU!!!

# MATE ROVER* Teacher Workshop

*ROV Education and Resources

Saturday, November 14, 2009

Monterey Peninsula College

***Using Underwater Robots to Teach Technical & Teamwork Skills***

Before the workshop starts, please take a few moments to complete this short survey. There will be another short survey at the end of the training to find out how useful it was for you.

1. How comfortable are you facilitating STEM (science, technology, engineering and math) learning experiences for students?
   - ☐ Very comfortable
   - ☐ Somewhat comfortable
   - ☐ Neutral
   - ☐ Somewhat uncomfortable
   - ☐ Very uncomfortable
   - ☐ Don't know

2. Do you have any concerns about mentoring students <u>in designing and building an ROV</u>?
   - ☐ Yes
   - ☐ No
   - ☐ Don't know

3. If so, what are your concerns? (Please check all that apply.)
   - ☐ Recruiting students
   - ☐ Having the technical skills and expertise
   - ☐ The time commitment
   - ☐ Integrating this activity into existing curriculum
   - ☐ Other: Please explain: _____
   - ☐ NA – I don't have any concerns.

4. What would you like out of today's workshop?

Thank you!!

MPC
MONTEREY PENINSULA
COLLEGE

# MATE ROVER* Teacher Workshop

*ROV Education and Resources

Saturday, November 14, 2009

Monterey Peninsula College

***Using Underwater Robots to Teach Technical & Teamwork Skills***

Please take a few moments to share your opinions about the training. Your feedback will help us improve the training and support that we provide for you.

1. How would you rate the usefulness of this training?
    a. Excellent
    b. Good
    c. Fair
    d. Poor

2. After this training, how confident do you feel about facilitating STEM learning experiences for students?
    - ☐ **Much more** confident
    - ☐ **Somewhat more** confident
    - ☐ **Same** level of confidence
    - ☐ **Somewhat less** confident
    - ☐ **Much less** confident

3. Has this training addressed your concerns about mentoring students in designing and building an ROV? Do you feel…
    - ☐ Less concerned
    - ☐ Unchanged
    - ☐ More concerned
    - ☐ NA – I didn't have any concerns

4. After this training, do you intend to mentor a student team in designing and building an ROV?
    - ☐ Yes
    - ☐ Maybe
    - ☐ No

5. As a result of this training, how committed do you feel about participating in the ROV competition?
    - ☐ More committed
    - ☐ Unchanged
    - ☐ Less committed

*more* →

6. How could we help ensure that the ROV competition process (designing, building, and competing) is a good experience for you?

7. What area would you like to see addressed in a focused workshop?

Thank you!!

MPC
MONTEREY PENINSULA
COLLEGE

Your feedback on the ROV competition will help us to improve the quality of the program and future events. The information that you provide on this survey is confidential! Only summary results will be reported.

If you are not the only instructor or mentor to accompany the team to the competition, please collaborate with your colleague(s) so that we have the benefit of your joint consensus view.

## 1. What is the name of your school or club?

## 2. Are you a:

- ◯ classroom instructor and/or faculty after-school club advisor.
- ◯ working professional acting as the teams' primary mentor.
- ◯ working professional helping the team in various ways.

## 3. If you are faculty, what grade level(s) do you teach?

## 4. How many years have you worked with an ROV competition team from the school or club you named above?

Some of the following questions can best be answered by faculty; others can be answered by either faculty members or working professionals acting as mentors. If you are a mentor and are unsure of the answer to a particular question, please leave it blank.

## 5. How many students worked on this project?

## 6. How did you incorporate this competition into your curriculum?

- ☐ Part of a course
- ☐ Voluntary activity
- ☐ After-school club
- ☐ Other (please specify)

## 7. Overall, how much elapsed time did the students spend on the ROV project?

months

or weeks

## 8. Over the period that you and your students worked on the ROV project, how many times did you meet?

**9. Would your team have been able to compete if the MATE Center did not provide funds to help support meals, travel, etc?**

- ◯ Yes
- ◯ Yes, but the money would come from the team members
- ◯ Yes, the school would have paid for everything
- ◯ No
- ◯ Other (please specify)

**10. Regarding the support funds provided by MATE, please rank in order of importance (1-3) the following: Funds for…**

| | 1 Most important | 2 | 3 |
|---|---|---|---|
| Meals | ◯ | ◯ | ◯ |
| Travel (if applicable) | ◯ | ◯ | ◯ |
| Other | ◯ | ◯ | ◯ |

Please specify:

**11. How would you rate competition logistics and housekeeping arrangements (transportation, housing, meals, information)?**

- ◯ First rate
- ◯ Pretty good
- ◯ Fair
- ◯ Marginal
- ◯ Pretty bad
- ◯ Other (please specify)

**12. Any comments on competition logistics and housekeeping arrangements?**

**13. Overall, were the competition events well-led and well-organized, with ample opportunity for participant interaction?**

- ◯ Yes, first-rate
- ◯ Pretty much
- ◯ Somewhat, but not entirely
- ◯ Just marginally
- ◯ No, they were very bad
- ◯ Other (please specify)

**14. Any comments on how well the competition events were led and organized, was there ample opportunity for participant interaction?**

**15. How helpful were the competition sessions? Feel free to add comments. Be sure to note the number of the question you are responding to.**

| | Not Useful at All | Not Very Useful | Somewhat Useful | Pretty Useful | Very Useful |
|---|---|---|---|---|---|
| Poster display | ◯ | ◯ | ◯ | ◯ | ◯ |
| Engineering evaluation | ◯ | ◯ | ◯ | ◯ | ◯ |
| Presenters | ◯ | ◯ | ◯ | ◯ | ◯ |
| Underwater mission | ◯ | ◯ | ◯ | ◯ | ◯ |
| Ocean Career Expo | ◯ | ◯ | ◯ | ◯ | ◯ |

Comments:

## 16. Please indicate the degree to which you agree with each of the following statements by checking the appropriate box.

| | Not at All | A Little | A Fair Amount | A Great Deal |
|---|---|---|---|---|
| I modified my course/club curriculum based on competition-related information and training so that my students could participate in this competition. | ◯ | ◯ | ◯ | ◯ |
| I used MATE or other competition-related materials/ resources to incorporate the ROV building project into my course or club. | ◯ | ◯ | ◯ | ◯ |

## 17. Please indicate the degree to which you agree with:

| | Not at All | A Little | A Fair Amount | A Great Deal | Don't plan to Compete Again |
|---|---|---|---|---|---|
| I intend to use what I learned through the competition to work with future students and prepare teams for future competitions | ◯ | ◯ | ◯ | ◯ | ◯ |

## 18. Please indicate the degree to which you agree with each of the following statements by checking the appropriate box.

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| The MATE competition provided a valuable venue that I can use to help prepare my students for careers in marine science & technology. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I feel that this competition helped motivate my students to learn technical skills. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I feel that this competition helped motivate my students to learn team building, problem solving, and/or critical thinking skills. | ◯ | ◯ | ◯ | ◯ | ◯ |

## 19. To what extent have you observed each of the following changes since your students began designing and building their ROV?

| | Not at All | A Little | A Fair Amount | A Great Deal |
|---|---|---|---|---|
| My students are more interested in learning about science, technology, engineering and math (STEM). | ◯ | ◯ | ◯ | ◯ |
| My students are more interested in pursuing a STEM career. | ◯ | ◯ | ◯ | ◯ |
| My students have increased their STEM knowledge and skills. | ◯ | ◯ | ◯ | ◯ |
| My students have increased their skills in team building, problem solving, and/or critical thinking. | ◯ | ◯ | ◯ | ◯ |

This year's competition theme highlighted Loihi, an active undersea volcano. In preparation for the technical report and poster display, you were asked to present information about Loihi, including the processes that created it and/or the research, technologies, and/or people who explore and study it.

## 20. What resources did you use in your research?

- ☐ Web sites (specify, if possible under other)
- ☐ Journals, newsletters, and/or other print publications
- ☐ Interviews with working professionals or employers
- ☐ Asked a colleague, spouse, and/or partner
- ☐ Other (please specify)

## 21. How much did the work with your students to prepare for this competition contribute to your own knowledge about undersea volcanoes?

- ◯ Not at all
- ◯ A little
- ◯ A fair amount
- ◯ A great deal

**22. Has the competition opened up other education or career opportunities (e.g., scholarships, internships, professional development opportunities, partnerships with other schools or industry, job offers, etc.) for you?**

- ◯ No
- ◯ Yes, please describe:

**23. Has the competition opened up other education or career opportunities (e.g., scholarships, internships, professional development opportunities, partnerships with other schools or industry, job offers, etc.) for your students?**

- ◯ No
- ◯ Yes, please describe:

**24. Overall, how would you rate the usefulness of the competition?**

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

Comments:

**25. How did you learn about the competition?**

The MATE Center is interested in continuing to be a source of support for your work. If you are willing, please provide us with your name and permanent e-mail and/or snail mail address so that we can contact you in the future. MATE will not share your e-mail and mailing addresses with any other person or organization.

## 26. Contact information

| | |
|---|---|
| First name | |
| Last name | |
| E-mail | |
| Mailing address line 1 | |
| Mailing address line 2 | |
| City | |
| State | |
| Zip code | |
| Phone number (please indicate home, office, or cell) | |

**27. One easy way for you to keep in touch with the MATE Center – and for MATE to keep in touch with you – is through MATE's alumni web site. As a condition of participation in the ROV competition, you were required to register with MATE's "AlumniWeb" at www.marinetech.org/alumni/. We thank you for registering and would appreciate hearing from you over the years as you progress in your education and career!**

**THANK YOU!!!**

# MATE ROV Competition Parent Survey

## 1. Default Section

Dear Parent/Guardian: We would like to hear your thoughts about your child's involvement in the MATE ROV Competition and building an underwater robot. Your input will help us improve our programs. Your responses are anonymous so please be candid. Thank you!

### 1. Which regional ROV competition is your child involved in?

| | |
|---|---|
| Regional ROV Competition: | |

### 2. How many of your children are participating in the ROV (underwater robotics) competition today?

- ◯ 0
- ◯ 1
- ◯ 2 or more

### 3. Has building an ROV made your child more interested in science, math, technology, or engineering? Less interested? Did it not make any difference?

- ◯ More interested
- ◯ Less interested
- ◯ No difference

### 4. Has building an ROV improved your child's grades in any of the subjects listed below?

| | Yes | No | Doesn't apply (Your child doesn't study the topic) |
|---|---|---|---|
| Science | ◯ | ◯ | ◯ |
| Math | ◯ | ◯ | ◯ |
| Computers | ◯ | ◯ | ◯ |
| Engineering/Robotics | ◯ | ◯ | ◯ |
| Other | ◯ | ◯ | ◯ |

Other (please specify)

# MATE ROV Competition Parent Survey

**5. What changes have you seen in your child as a result of their involvement in the ROV project? (Please mark all that apply)**

- [ ] More organized
- [ ] Better able to work with others
- [ ] Improved self confidence
- [ ] Other changes?

Other (please specify)

**6. As a parent/guardian, how much influence do you have on your child's choice of careers?**

- ◯ A lot
- ◯ Some
- ◯ None
- ◯ Not sure

**7. Has participation in the ROV program changed how you envision your child's future? Is it easier to picture your child with a career in science, technology, engineering or math?**

- ◯ Yes
- ◯ No
- ◯ Not sure

**8. Overall, how would you rate your child's experience building and competing with an ROV?**

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Not sure

# MATE ROV Competition Parent Survey

### 9. Does your child attend…

- ◯ Elementary school
- ◯ Middle school/junior high
- ◯ High school
- ◯ College/university
- ◯ Other

Other (please specify)

### 10. Additional comments:

# 2010 MATE ITEST Teacher Follow-up Survey

Welcome to the MATE ROV Program Teacher Follow-up Survey! We appreciate you taking the time to complete this survey, which will help us improve the program. A summary of the results will also be shared with our funder, the National Science Foundation. This short survey will take 5-8 minutes to complete. Thank you again for your help!

### 1. Which ROV program region applies to you?

- ◯ Monterey
- ◯ New England
- ◯ Pacific Northwest
- ◯ Southern California

Other (please specify)

### 2. Did you attend any workshops related to the ROV program?

- ◯ Yes
- ◯ No

### 3. Did you mentor a student team in building an ROV?

- ◯ Yes
- ◯ No

### 4. Did your team participate in the competition or other "finale" event?

- ◯ Yes
- ◯ No

### 5. How would you rate your experience in the ROV program?

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Very poor
- ◯ Not sure

# 2010 MATE ITEST Teacher Follow-up Survey

### 6. How would you rate the support provided by the ROV program?

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Very poor
- ◯ Not sure

### 7. What obstacles did you face in the ROV program? (Please mark all that apply)

- ☐ Recruiting students
- ☐ Having the technical skills and expertise
- ☐ The time commitment
- ☐ Integrating this activity into existing curriculum
- ☐ Not enough support from MATE
- ☐ Not enough resources

Other (please specify)

### 8. Do you have any suggestions for how the program can better support you?

### 9. Please share some reflections on your experience with the program.

# 2010 MATE ITEST Teacher Follow-up Survey

**10. Please share some reflections on your students' experience in the program.**

**11. Do you plan to participate next year?**

- ◯ Yes
- ◯ No
- ◯ Not sure

**12. You indicated that you plan to participate again next year. Could you please specify what led to this decision?**

**13. You indicated that you do not plan to participate again next year. Could you please specify what led to this decision?**

**14. You indicated that you are not sure if you will participate again next year. Could you please specify what what factors you will consider in making this decision?**

**15. Is there anything else you'd like to share about your experience?**

Thank you for providing your feedback about the ROV program!

2010 ITEST Interview Protocol

1. I'm interested in hearing how ITEST was implemented in your region. Could you please walk me through the process?
    a. Recruiting teachers and students
    b. Teacher workshops
    c. How were students trained?
    d. What was the culminating event? Participation in the regional or a separate competition?
    e. How was student and teacher retention?
    f. Partnerships with industry and other regional organizations

2. Who was involved with the grant implementation? What were their roles?

3. Did you facilitate the teacher workshops?

    a. If yes: how did they go? What was the teacher response to the workshops?
    b. Was the curriculum effective?
    c. Did they result in increased confidence among the teachers in their ability to facilitate a STEM learning experience?
        i. Increased awareness of ocean STEM careers?
        ii. Increased commitment to lead a student team?
    d. Do you feel that the teachers need additional support? What are the main obstacles that they face?

4. Let's talk about student outcomes: Among students, did you see increased interest in STEM? In STEM careers? Increased STEM knowledge? Increased SCANS skills?

5. Did you have much contact with parents? How would you characterize their level of support for their children's interest in STEM careers? Their level of support for the competition as a whole?

6. Let's talk about successes. What went well with the grant implementation in your region?

7. What was challenging with the grant implementation in your region?

8. Do you have any tips for the regions coming online next year?

9. Do you plan to make any changes next year?

10. How would you rate MATE's support of the regionals implementing this grant?

11. Do you have any comments about the effectiveness of the materials and websites provided by MATE?

12. That wraps up my questions for you. Is there anything else you'd like me to know?

Thank you!

# MATE ROVER* Teacher Workshop

*ROV Education and Resources

Saturday, November 14, 2009
Monterey Peninsula College

## *Using Underwater Robots to Teach Technical & Teamwork Skills*

The **Marine Advanced Technology Education (MATE) Center at Monterey Peninsula College (MPC)** uses underwater robots (aka remotely operated vehicles or ROVs) as a fun and engaging way to teach students science, technology, engineering, and math (STEM) skills. Designing and building ROVs also challenges students to work as a team, solve problems, and think critically and creatively.

And it doesn't end there. The MATE Center coordinates international and regional student ROV competitions. These events give students the chance to put their education to the test while having fun, making new friends, and learning from each other and professionals from the ocean workplace.

Now, through its **Innovative Technology Experiences for Students and Teachers (ITEST)** grant from the **National Science Foundation**, MATE offers teachers and students have the opportunity to become "**ROVERs**." See below to learn how!

***Who?*** Grade 5-8 teachers who serve students from populations that are traditionally underrepresented in science and engineering. These include ethnic minorities as well as socio-economically disadvantaged youths.

***What?*** An all-day, hands-on underwater technology workshop where teachers will:

- Design and build a fully-functional ROV to take back to their classrooms.
- Learn how to use ROVs to teach STEM, teamwork, and other important skills.
- Experience the same excitement and sense of accomplishment that students will experience when operating ROVs in a competition setting.
- Acquire the knowledge, skills, and curriculum resources necessary to effectively mentor students in designing and building their own ROVs.
- Network with other local teachers who share similar interests and experiences.

***Where?*** At the Automotive Technology facility on the campus of Monterey Peninsula College.

***When?*** 8:30am—5:30pm on Saturday, November 14th. **Breakfast goodies and lunches are provided!**

***How*** to implement the ROV project with your students? Teachers create courses or clubs where they introduce then guide their students through the ROV design and building process. MATE will provide each teacher participant with the following resources:

- A course outline and curriculum materials, including PowerPoint presentations and videos
- ROV building materials, supplies, tools, and equipment
- Access to professional engineers and technicians and community college faculty and students who will visit your school to help deliver information and assist your students with construction
- The opportunity for a team of your students to participate in the MATE Monterey Bay Regional ROV Contest




# MATE ROVER Teacher Workshop

## Application deadline: November 5, 2009*

### Background

1. **Name:** _____ **E-mail:** _____

2. **Are you currently working as a teacher?**
   a. Yes
   b. No. If not, what position do you have? _____
   *(If you are not a teacher, please skip to Question 8.)*

3. **School name:** _____

4. **Extended learning/GATE coordinator or school administrator's name:** _____

5. **Grade(s)/subject(s) currently teaching:** _____

6. **Number of years teaching (any subject):** _____

7. **Number of years teaching math or science:** _____

8. **Do you have any degrees in math or science?**
   a. Yes
   b. No

9. **Do you have any professional experience in a math or science field (aside from teaching)?**
   a. Yes
   b. No

10. **Have you led a team in the MATE ROV competition before?**
    a. Yes
    b. No

11. **Have you led a team in other math/science student competitions before?**
    a. Yes: Which competition(s)? _____
    b. No

### Demographics (yours, not your students)

12. **Gender**
    a. Female
    b. Male

13. **Ethnicity**

| | | |
|---|---|---|
| a. White | d. Asian | g. American Indian or Alaska Native |
| b. African American/Black | e. Filipino/a | h. Multiple Ethnicities |
| c. Hispanic/Latino/a | f. Pacific Islander | i. Other _____ |

**Note:** The MATE Center is excited to offer the ROVER opportunity to you and your students—but we will need your help. As a participant in this workshop, we expect that you will mentor students in ROV design and building projects this coming spring. We also expect that you and your students will participate in project evaluation surveys, which will be provided by our National Science Foundation ITEST project evaluator.

***Questions, or to submit your application, contact:**
**Jill Zande**
**MATE Associate Director & ITEST Project Principle Investigator**
**980 Fremont Street**
**Monterey, CA 93940**
**jzande@marinetech.org or (831) 646-3082**

# MATE ROVER* Teacher Workshop

*ROV Education and Resources

Saturday, November 14, 2009

Monterey Peninsula College

## *Using Underwater Robots to Teach Technical & Teamwork Skills*

**AGENDA**

8:15 – 8:30am: Arrival and breakfast goodies provided by MATE

8:30 – 8:45am: Welcome and introductions

8:45 – 9:30am: Information about the MATE Center and ROVER

9:30 – 10:15am: ROV Anatomy 101

10:15 – 11:30am: ROV-in-a-bag – a quick and easy way to get hooked!

11:30am – 12:00pm: Lessons learned from ROV-in-a-bag – what worked and what didn't work?

12:00 – 12:45pm: Lunch provided by MATE

12:45 – 2:00pm: The science behind designing and building simple, yet functional ROVs

2:00 – 4:45pm: Putting your skills to the test – design and build your very own vehicle

4:45 – 5:15pm: Implementing ROVER at your school – next steps

5:15 – 5:30pm: Pack up your ROVs and head home!

MPC
MONTEREY PENINSULA
COLLEGE

# MATE ROVER after-school club/course outline

**This is a PROPOSED outline for you to follow as you implement the ROV project with your students. The MATE Center staff will work with you to come up with a plan that best suits your schedule and meets your needs!**

- January – March
  - 6 weeks, 2 days per week, 2 hours (2:30-4:30pm) per day = 24 hours contact time (minimum grant requirement is 20 hours contact time)

- Course schedule
  - Week 1
    - Introduction to ROVs
    - ROV-in-a-bag activity (borrow re-usable kits from the MATE Center)
    - Introduction to the materials and tools for designing and building their own ROVs
    - Info about Monterey Bay regional contest
    - Info about after-school club mini-contest

  - Week 2
    - Electronics, simple circuits, and wiring the control box (volunteers come in to help)
    - Wiring the control box and motors (volunteers come in to help)

  - Week 3
    - Finish the control box/motor assembly(volunteers come in to help)
    - Design and piece together the frame

  - Week 4
    - Incorporate the motors into the frame, work on buoyancy
    - Select and incorporate payload tools into the frame
    - Buoyancy testing

  - Week 5
    - Fine-tune buoyancy, practice piloting
    - More practice time, work time

  - Week 6
    - More practice time, work time
    - Mini-contest where the top winners move on to SCOUT class competition at Monterey Bay regional, which is being held at MPC on April 24th

# MATE ROVER classroom toolkit

**Your tool kit will consist of the following:**

- Set of 6 Phillips and flathead screwdrivers, medium and large
- Set of 2 Phillips and flathead screwdrivers, small
- Medium-Small needle nose pliers
- Medium pliers
- Soldering kit (soldering gun, solder, and more)
- Small wire cutters
- Wire strippers
- Electrical tape
- Duct tape
- PVC cutters
- Crimpers
- Drill, drill bits
- WD-40
- 12-volt car battery
- Plastic battery case
- Battery charger
- Multi-meter
- Toolbox

marine technology SOCIETY

Opportunity runs deep™

# THE MARINE TECHNOLOGY SOCIETY, Puget Sound Section and MARINE ADVANCED TECHNOLOGY EDUCATION CENTER

## Invite YOU to join in ROV Workshops and Student Activities!!!

We seek **ten teachers** and their **students in grades 6 through 8** to explore oceanography and physics through underwater **REMOTELY OPERATED VEHICLES (ROVs)**. The program and materials are **free to teachers**. Travel expenses can be reimbursed as well.

Designing, building, and operating underwater ROV's is a great way to engage students in hands-on activities that explore not only the math and science behind them, but the world around us today. In a teacher workshop held Saturday **December 12th, 2009** at the Univ. of Washington's School of Oceanography you will learn about and build your own ROV. Additionally, you will **take your own ROV home** with suggested lessons to engage your class around this resource. You can extend this opportunity even farther by having a team of your students compete at the regional ROV competition held each May. Financial support for competition teams & ROVs will be available by application to a local organizing committee - more details at the workshop.

**To sign up** and for more information please **contact**:

**Kailey Genther: ireland8@u.washington.edu or 206-221-6728**

MATE

MARINE ADVANCED TECHNOLOGY EDUCATION CENTER

## GRANT OPPORTUNITY for FUNDING SCOUT CLASS ROV's

Dear ROV Workshop Participant,

We would like to thank those who attended our teacher workshop in December and welcome you to the Pacific Northwest Regional ROV Challenge. As we mentioned, we have funding available to help support your ROV-based learning activities, and bring teams to the competition in May. These funds are available to all Scout teams and December workshop participants.

**You may use grant funding for:**

- **Supplies for building ROVs**
- **Tools for building ROVs**
- **Travel for students to the competition in Federal Way**

If you are interested in applying for funding, please fill out the application below. Feel free to contact us with any further questions.

Best Regards,
MATE Pacific Northwest ROV Challenge Team (Rick, Fritz, and Kailey)
Kailey Genther: ireland8@uw.edu
(206)221-6728

## APPLICATION

Please complete the following application and return it electronically **by March 1st** to Kailey Genther at: ireland8@uw.edu

### Part I:

| |
|---|
| **Name:** |
| **Contact Phone Number:** |
| **Contact E-mail:** |
| **School & City:** |
| **Age Group(s):** |
| **Number of students participating in making ROV's at your school:** |

### Part II:

Please write a short explanation of why you need funding, and what it will be used for. Please include how these funds relate to either your ROV-based learning activities or attending the regional ROV competition in May?

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:
12-15 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 10/05/2009

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Introductions
- Basic Steps of the Engineering Design Process
  - Include first step (Brainstorming)
- Teamwork
- Communication

6. MATERIALS/PREPARATION NEEDED:

- Straws (100 per group)
- Masking Tape
- 8.5x11 sheets of paper (20 pieces)

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS*):

1) In small groups have the kids build the tallest standing structure with the ability to hold a figurine.

RULES: No other materials may be used EXCEPT for the ones provided, no taping to the floor, walls, ceiling or desks, MUST work as a team.

2) Individually have students close their eyes and listen to instructions from the CT's. Basic commands such as tear right corner, fold, tear left corner, fold and repeat.

RULES: MUST have eyes closed, no talking.

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process
- Do a mini activity related to that day's engineering step and/or building step

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

13-17 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 10/19/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Separate into FINAL Groups
- Basic Steps of the Engineering Design Process
  - Brainstorming Frame Design
  - Expose the Students to the Materials and Connectors
- Crash Course in Drawing 3D Objects by Hand
- Teamwork
  - With Activity
- Communication

6. MATERIALS/PREPARATION NEEDED:

- Container Filled with Water
- Duct Tape
- Paper Cups (8 ounces at least)
- 10-inch strip of Plastic Wrap
- 10 Straws
- Towels
- 25 Pennies
- 10' of Rope
- PVC Pipe
- Connectors

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS*):

1) In FINAL groups, have the students build a watercraft that will not sink with a load of about 25 pennies and that can hold the most amount of pennies before sinking.

RULES: No other materials may be used EXCEPT for the ones provided. MUST work as a team.

2) In FINAL groups, have the students stand up, close their eyes and form shapes with the given tied rope.

RULES: All students MUST have their eyes closed, all students MUST hold onto the rope the entire time of the activity.

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process
- Do a mini activity related to that day's engineering step and/or building step

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

10-15 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 10/26/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Basic Steps of the Engineering Design Process
  - Brainstorming Frame Design
  - Expose the Students to the Materials and Connectors
- Crash Course in Drawing 3D Objects by Hand (Part II)
- Teamwork
  - With Activity
- Communication

6. MATERIALS/PREPARATION NEEDED:

- 10' of Rope
- Varies sizes of cardboard
- 8.5x11 sheets of blank paper
- Duct Tape
- CPVC Pipe
- Connectors

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS)*:

1) In groups, have the students stand up, close their eyes and form shapes with the given tied rope.
RULES: All students MUST have their eyes closed, all students MUST hold onto the rope the entire time of the activity.
2) In groups, have the students prototype what the frame of their ROV will look like.
RULES: Design MUST first start out on paper. ONLY cardboard, paper and duct tape will be used. Communication is a MUST.

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process
- Do a mini activity related to that day's engineering step and/or building step

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

10-17 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 11/9/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Basic Steps of the Engineering Design Process
  - Build Frame
- Crash Course in Drawing 3D Objects by Hand (Part II)
- Teamwork
  - With Activity (Blind Polygon)
- Communication

6. MATERIALS/PREPARATION NEEDED:

- 20' of Rope
- CPVC Pipe
- Connectors
- Pipe Cutters
- Rulers
- Safety glasses
- Prototype Frames (cardboard)

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS)*:

1) In ONE big group, have the students and teachers stand up, close their eyes and form shapes with the given tied rope (20').

RULES: All participants MUST have their eyes closed, all participants MUST hold onto the rope the entire time of the activity.

2) In the designated groups, have the students build their prototype ROV.

RULES: MUST work together on the design from previous meeting. EVERYONE MUST exercise caution and have safety glasses on at all times.

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

10-17 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 11/16/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Basic Steps of the Engineering Design Process
  - Finish constructing frames
  - Brainstorm motor placement
- Talk about science of propellers
- Teamwork
- Communication

6. MATERIALS/PREPARATION NEEDED:

- Prototypes
- PVC Pipe
- Connectors
- L-Brackets
- Batteries
- Motors
- Prop Adaptors

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS)*:

1) In FINAL groups, finish constructing the frame
2) Go over the differences in propellers
3) Talk about the center of mass and motor placement

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

10-17 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 11/30/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Basic Steps of the Engineering Design Process
  - Brainstorm motor placement
  - Mount motors
- Talk about science of propellers
- Teamwork
- Communication

6. MATERIALS/PREPARATION NEEDED:

- Prototypes
- PVC Pipe
- Connectors
- L-Brackets
- Batteries
- Motors
- Prop Adaptors
- Safety Glasses

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS*):

1) Go over the differences in propellers
2) Talk about the center of mass and motor placement
3) In FINAL groups, brainstorm where the motors should be placed

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

10-17 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 12/7/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Basic Steps of the Engineering Design Process
  - Brainstorm motor placement
  - Mount motors
- Mount floatation
- Add tether
- Talk about science of propellers
- Teamwork
- Communication

6. MATERIALS/PREPARATION NEEDED:

- PVC Pipe ROV
- Connectors
- L-Brackets
- Batteries
- Motors
- Prop Adaptors
- Hose clamps
- Hooks
- Floatation
- Safety Glasses

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS)*:

1) Go over the differences in propellers
2) Talk about the center of mass and motor placement
   - Floatation
3) Mount motors and floatation

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# APPRENTICESHIP LESSON PLAN OUTLINE

1. APPRENTICESHIP NAME:
Underwater Exploration with ROV's

2. MAX # OF STUDENTS/ SESSION AND SPACE NEEDED:

10-17 Students

3. CT(S): Kate and Josh

4. DELIVERY DATE(S): 12/14/09

5. ACTVITY OBJECTIVES (2-3) INCLUDE CONTENT FOCUS:

- Basic Steps of the Engineering Design Process
  - Brainstorm motor placement
  - Mount motors
- Mount floatation
- Add tether
- Talk about science of propellers
- Teamwork
- Communication

6. MATERIALS/PREPARATION NEEDED:

- PVC Pipe ROV
- Connectors
- L-Brackets
- Batteries
- Motors
- Prop Adaptors
- Hose clamps
- Hooks
- Floatation
- Safety Glasses

7. ACTIVITY INSTRUCTIONS/RULES (*HOW YOU EXPLAIN OBJECTIVES/ INSTRUCTIONS/RULES TO STUDENTS)*:

1) Go over the differences in propellers
2) Talk about the center of mass and motor placement
   - Floatation
3) Mount motors and floatation

8. DEBRIEL/REFLECTION RITUAL DESCRIPTIONS:

- Review Engineering Design Process
- Review for WOW!

9. CRITERIA FOR RIGOR:

- Directions clearly explained verbally and visually
- TLs participates and encouraging students in activity
- Basic _____ content skills practiced
- Conclude with brief but meaningful reflection/ debrief and track student progress/ performance whenever possible
- Includes college and career connections
- Meaningfully incorporates New Basic Skills

10. CD/CTL FEEDBACK:

# 1st Annual MATE Center
# ITEST Summer Institute
## *Basic Level Remotely Operated Vehicle (ROV) Building for Class or Club Projects*
## July 12th – July 18th, 2010
## Monterey, California

## Application Form

***To apply for this institute, we require the name, contact information, and a letter of support from an administrator at your school or organization in addition to the completed application form.***

Name_____

Title_____

School/Organization_____

School/Organization Address_____

City_____State_____Zip_____WK Phone (  )_____

Home Address_____

City_____State_____Zip_____

HM Phone (  )_____ Cell Phone (  )_____

E-mail_____FAX (  )_____

Administrator Name _____

Title_____

E-mail_____ Phone (  )_____

FAX (  )_____

Local MATE/ITEST Contact: _____

E-mail_____

**Please remember to include the following information with your application form:**

• A letter of support from an administrator at your school or organization that demonstrates how they are supporting your efforts to incorporate underwater technology into your curriculum or club activities and to engage your students in STEM.

• Please help us to better understand your needs by providing a brief answer to the following questions:

1. What do you hope to gain during this institute for yourself and your students?

_____
_____
_____
_____

2. What other professional growth opportunities, similar to this institute, have you had?

_____
_____
_____
_____

3. What additional skills, beyond those that you learned in your first MATE/ITEST workshop, would you like to gain from this institute?

_____
_____
_____
_____

4. What additional information about STEM applications, ocean careers, college preparation, or marine technology would you like to have provided to you during this institute?

_____
_____
_____
_____

5. Please help us gauge your knowledge and skills. Select one for each question.

5a. Understanding of electronics
- ☐ I have my own circuit tester and analyzer and know how to use them
- ☐ Black is positive, red is negative, and white is ground.
- ☐ How do you spell DC?

5b. Understanding of electricity
- ☐ I have wired my house.
- ☐ I know my ohms from my volts
- ☐ I don't put forks in the toaster... anymore.

5c. Ability to solder
- ☐ Here is a microcontroller board I assembled.
- ☐ I know a cold solder when I see one.
- ☐ Is something burning?

6. What is your gender & ethnic background (Optional question)

☐ Female ☐ Male

- ☐ White
- ☐ African American/Black
- ☐ Hispanic/Latino
- ☐ Asian
- ☐ Filipino
- ☐ Pacific Islander
- ☐ American Indian or Alaskan Native
- ☐ Multiple Ethnicity
- ☐ Other (please specify) _____

7. Tell us about your teaching background (select all that apply).

**Grade Level**
- ☐ Elementary
- ☐ Middle or Jr. High
- ☐ High School
- ☐ 2 year college or technical school
- ☐ 4 year institution
- ☐ Other (please specify) _____

**Subjects**
- ☐ Math
- ☐ Sciences: biology, physics and chemistry
- ☐ Marine sciences and/or marine technology
- ☐ Computer sciences
- ☐ Engineering
- ☐ Other (please specify) _____

**Please provide some background information on your school or organization.**

8. Does your school or organization currently offer classes, clubs or electives in the following areas marine related field(s)?

☐ Math
☐ Sciences: biology, physics and chemistry
☐ Marine sciences and/or marine technology
☐ Computer sciences
☐ Engineering
☐ Other (please specify) _____

9. Does your school or organization currently offer courses, electives, or programs in robotics?

☐ No
☐ Yes – please specify _____

10. Please check any of the following that are available at or near your location:

☐ Electronics lab
☐ Hydraulics lab
☐ Computer lab
☐ Physics lab
☐ Automotive lab
☐ GIS/Auto CAD lab
☐ Swimming pool
☐ Mechanics lab

11. What is the composition of the student population served by your institution? (ethnic composition, percent of free & reduced lunch, economic level, grades served, etc.)

_____
_____
_____

12. Is there any other student information you would like to tell us?

_____
_____
_____
_____

**Applications will be accepted until the class is filled. For priority screening, submit by May 30th, 2010. If you are applying later than May 30th, 2010 please call or email to find out the current application acceptance status.**

---

**SEND TO:**
Erica Moulton
The MATE Center
Monterey Peninsula College
980 Fremont Street
Monterey, CA 93940

**OR FAX TO:** (727) 894-6821

**OR EMAIL TO**: emoulton@marinetech.org

# 2010 Basic Session ROV Participants

| Name | Institution |
|---|---|
| Jessica Paine | Hydesville, CA - Humboldt 4 H |
| Suzanne Acone | Long Beach, CA – LBCC ITEST |
| | |
| Marie Sofsak | Woodinville, WA – Timbercrest Junior High |
| Jane Maczuzak | American School in Japan |
| | |
| Timmie Sinclair | Slidell, LA – Acorns to Oaks School |
| Beth Wile | Orlando, FL – Union Park Middle School |
| | |
| Eric Fernandez | Tampa, FL – Terrace Community Middle School |
| Adam Hough | Tampa, FL – Terrace Community Middle School |
| | |
| James Graham | Ladson, SC – Zucker Middle School |
| Jaden Nunes | Fall River, MA – Boys & Girls Club |
| | |
| DeDee Ludwig | Chicago, IL - Shedd Aquarium |
| Axel Lucca | Monterey, CA - Colton Jr. High |
| | |
| Jennifer Westerbeck | Salinas, CA – Alisal High School |
| Grant McMicken | Salinas, CA – Alisal High School |

# The 1st Annual MATE Center ITEST Summer Institute

## *Basic Level ROV Building for Classroom Projects*

## July 12th – July 18th, 2010

*7/30/2010*

**DAY 1 – Monday, July 12th**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 1:00 pm | Trip to Monterey Bay Aquarium (OPTIONAL)<br>Van pick-up at Monterey Bay Lodge | Monterey Bay Aquarium | Visit and enjoy the Monterey Bay Aquarium |
| 7:00 pm – 8:30 pm | Welcome reception (MATE will provide food and drinks) | Monterey Bay Lodge pool area | Meet your instructors and fellow participants and get basic information about the week |

**DAY 2 – Tuesday, July 13th**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 8:00 am | Van leaves from Monterey Bay Lodge to travel to MPC | MPC Life Sciences (LS) 101 | |
| 8:15 am – 8:30 am | Breakfast (coffee and pastries) | | |
| 8:30 am – 9:00 am | Welcome, introductions, logistics, and goals for the week – Erica Moulton (MATE) | | Review the schedule for the week and go over the goals and outcomes of the workshop |
| 9:00 am – 9:45 am | Introduction to ROVs – Matt Gardner (MATE) | | Why use ROVs to teach STEM? |
| 9:45 am – 10:45 pm | ROV in a Bag – Matt & Erica | | Work with a partner to design and build a basic ROV |

| | | | |
|---|---|---|---|
| 10:45 am – 11:00 am | Break | | |
| 11:00 am – 12:00 pm | ROV in a Bag – motor placement exercises | | Discover what happens when ballast and motors move on your ROV |
| 12:00 pm – 12:45 pm | Lunch | | |
| 12:45 pm – 1:15 pm | ROV building lab – the set up and safety of your lab and ours | MPC Life Sciences (LS) 101 | Safety, safety, safety! Learn how to set up your classroom to safely and conveniently design and build ROVs. (Great photo opportunities!) |
| 1:15 pm – 2:45 pm | Group frame building (screw don't glue!) and tool orientation | | Participate in a lesson on frame design and purpose and begin to sketch out your ROV frame. Also become familiar with the tools that you will use *and* how to use them. |
| 2:45 pm – 3:00 pm | Break | | |
| 3:00 pm – 5:30 pm | Frame design, materials, and methods | | Learn about different frame materials and begin to build your ROV frame |
| 5:30 pm – 6:00 pm | Biophobia activity | | Focus on team development and how we learn and think |
| 6:00 pm | Dinner around Monterey | | |

# The 1st Annual MATE Center ITEST Summer Institute

## *Basic Level ROV Building for Classroom Projects*

## July 12th – July 18th, 2010

*7/30/2010*

**DAY 3 – Wednesday, July 14nd**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 8:00 am | Van leaves from Monterey Bay Lodge to travel to MPC | MPC Life Sciences (LS) 101 | |
| 8:15 am – 8:30 am | Breakfast (coffee and pastries) | | |
| 8:30 am – 10:00 am | Incorporating ROVs into your curriculum – Joe Slovacek (Cerro Coso Community College) | | Find out more about how ROVs can be incorporated into STEM subject areas to increase learning opportunities |
| 10:00 am – 11:00 am | Basic circuit demonstration – Jeremy Hertzberg (Monterey Peninsula College) | | Gain an understanding of a basic electrical circuit |
| 11:30 am – 12:30 pm | Workforce development and the MATE Center – Deidre Sullivan (MATE Center) | | Obtain a wealth of information about marine technical careers that you can pass along to your students |
| 12:30 am – 1:30 pm | Lunch | | |
| 1:30 pm – 2:30 pm | Soldering and waterproofing workshop | | Learn various ways to connect wires, which includes making ring terminals, crimping, soldering, and heat shrink |

| | | | |
|---|---|---|---|
| 2:30 pm – 3:30 pm | Electricity!<br>Electrical safety, basic electricity, how a switch operates, and the use of a multi-meter | | Understand the basics of electricity and electronics, including AC vs. DC, ohms, and amps as well as how to draw an electrical circuit |
| 3:30 pm – 4:30 pm | Electrical troubleshooting – what to do when things go wrong! | | Learn basic troubleshooting techniques and how to approach the process of finding out what went wrong and how to fix it |
| 4:30 pm – 6:00 pm | Build your ROV's control box | | Put your skills to the test! Also, participate in a lesson on using a drill press and how it can make building your ROV control box much easier. |
| 6:00pm – 9:00 pm | Pizza dinner and optional lab time or dinner around Monterey | | |

**DAY 4 – Thursday, July 15th**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 8:00 am | Van leaves from Monterey Bay Lodge to travel to MPC | MPC Life Sciences (LS) 101 | |
| 8:15 am – 8:30 am | Breakfast (coffee and pastries) | | |

| | | | |
|---|---|---|---|
| 8:30 am – 10:30 am | Flotation and bollard testing discussions, demonstrations, and practice | | Learn how what floats (and what doesn't) and how to find the best propeller for the job |
| 10:30 am – 12:30 pm | Attach motors physically and electrically to your ROV | | Drill and create your own motor mounts, mount motors to your ROV's frame, and learn how to wire the motors to your control box via the tether |
| 12:30 pm – 1:15 pm | Lunch | | |
| 1:15 pm – 1:45 pm | Drive to MBARI | Monterey Bay Aquarium Research Institute (MBARI) www.mbari.org | See and learn about work class ROVs and the marine technology industry |
| 1:45 pm – 3:00 pm | MBARI vehicles – Bill Kirkwood and George Matsumoto (MBARI) | | |
| 3:00 pm – 5:00 pm | MBARI tour led by Bill Kirkwood (MBARI)<br><br>SCINI ROV demonstration by Bob Zook (Moss Landing Marine Labs www.mlml.calstate.edu/) & DJ Osborne (MBARI) | | See and learn about work class ROVs and the marine technology industry |
| 5:00 pm – 5:30 pm | Tour the vessels Knute Brekke (MBARI) | | |
| 5:30 pm – 6:15 pm | Vans return to hotel after dinner at Phil's | | |

**DAY 5 – Friday, July 16th**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 8:00 am | Van leaves from Monterey Bay Lodge to travel to MPC | MPC Life Sciences (LS) 101 | |
| 8:15 am – 8:30 am | Breakfast (coffee and pastries) | | |
| 8:30am – 9:45 am | Underwater cameras | | Build an underwater camera for your ROV |
| 9:45 am – 10:00 am | Break | | |
| 10:00 am – 11:00 am | ROV Competitions – Jill Zande (MATE Center) | | Find out more information about the MATE ROV competition program and how it can motivate your students to stick with ROVs (and STEM!) |
| 11:00 am – 12:00 pm | Payloads | | Your ROV moves but discover what else it can do! |
| 12:00 pm – 1:00 pm | Lunch | | |
| 1:00 pm – 2:00 pm | Team management discussions and activities focused on tethers, pilots, and missions | | Learn strategies to encourage students to recognize their own strengths as well as those of their team members |

| | | | |
|---|---|---|---|
| 2:00 pm – 6:00 pm | Continue ROV building by adding grippers, flotation, and working out buoyancy issues | | Fine-tune your ROV's buoyancy and see how to adapt your ROV to accomplish other missions |
| 6:00 pm – 9:00 pm | Lab and building time available<br><br>Auto Tech cookout hosted by Matt and Jeremy | | |

**DAY 6 – Saturday, July 17th**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 8:00 am | Van leaves from Monterey Bay Lodge to travel to MPC | MPC Auto Technology Lab | |
| 8:15 am – 8:30 am | Breakfast (coffee and pastries) | | |
| 8:30 am – 11:30 am | Attach cameras and finish ROVs | | Complete your ROV and get it ready for the pool |
| 11:30 am – 12:30 pm | Lunch | | |
| 12:30 pm – 1:00 pm | Transport ROVs to MPC pool and prep for missions | | |

| | | | |
|---|---|---|---|
| 1:00 pm – 4:00 pm | ROV demonstration in the MPC Pool | | Show off your ROV and new skills by tackling the mission tasks! |
| 4:00 pm – 5:30 pm | Clean up the pool area and the Auto Technology lab and classroom | MPC Pool and Auto Technology Lab | |
| 7:00 pm – 10:00 pm | Closing dinner and team presentations | MPC Library Technology Center, Sam Karas Room | Share what you and your team have learned during the week |

**Day 7 - Sunday, July 18th**

| TIME | ACTIVITY | LOCATION | Goal of Activity |
|---|---|---|---|
| 10:00 am | Check out | Monterey Bay Lodge | Heading home ☺ |

**Agenda and topics for discussion at regional coordinators' meeting**
**October 26, 2009**
**12:00 – 6:00pm**
**Beau Rivage**
**Azalia A Room**
**Biloxi, MS**

**12:00pm: LUNCH (sandwich "bar")**

**12:30 – 1:00pm: Welcome and introductions (continue eating!)**
Call-in for those not able to make it to the meeting (call-in information to come)

- MATE Center
    - Jill – include a BRIEF history of the competition
    - Deidre, Candiya, Matt – MATE Center roles
- Regional coordinators – include the organization that you're affiliated with and the organizations that help to carry out your regional event (venue, sponsors, etc.)

**1:00 – 1:45pm: General competition topics**

- Debrief 2009 competition
    - What worked and what didn't work from the international competition perspective
    - What worked and what didn't work from a regional contest perspective (open discussion)
    - Prop issues (Erica to share her notes from regional coordinators handbook)
- Plans for the 2010 competition
    - Matt to share information about the props

**1:45 – 2:45pm: Best practices**

- Florida
    - With a focus on logistics help – leads to discussion of role of regional coordinator in providing this support (include help with funding travel to international competition)
- Big Island
    - With a focus on community service – leads to discussion of ways to engage the local community, including sponsors (both financial and in-kind support)
- NL
    - With a focus on summer courses and other workshops – leads to a discussion of different ways to provide teachers and students with instruction

**2:45 – 3:30pm: Issues, challenges, and sustainability**

- Regional issues
    - Requests for teams to attend regionals other than the one closer to them because of…

        - Schedule conflicts (e.g. Geoff's team in the Great Lakes)
        - Other?

**3:30 – 3:45pm: BREAK (coffee, soda, cookies)**

**3:45 – 4:15pm: Competition handbook**

**4:15 – 6:00pm ITEST**

- Overview (15 minutes)
    - Recap of crib notes document
        - Obligations
        - Funding for regionals
    - Evaluation – Candiya

- Grant Year 1 regionals: Plans for implementation, including successes and/or challenges to date (1 hour)
    - Note about SCOUT class power specs (12 volt, 7.5 amp), motors and how mission theme is often tweaked so that it ties to the local area

    - Monterey
        - Our "normal" routine, adding ITEST
        - Successes
            - Extended learning, GATE program
            - Parents
        - Challenges
            - Budget and therefore morale woes
            - Stipends for teachers
    - PNW
    - Southern CA
    - New England

- Strategies for engaging: (30 minutes)
    - Diverse learners (Erica to share information from Jenny's workshop)
    - Parents (examples from Jenny De La Hoz)

**6:00pm Plans for next year's meeting and FINITO!**

**7:00pm DINNER TBD**

MATE ROV Competition Regional Coordinators meeting 10/26/09- Biloxi, MS

Start ~12:45pm

Attendees:

Jill Zande – MATE Center, Monterey Bay Regional
Erica Moulton – MATE Center, Florida Regional
Marcel Jones - volunteer, Florida Regional
Meghan Abella-Bowen – Bristol Community College, New England Regional
Francine White - Philadelphia Schools, Pennsylvania Regional
Zelda Maris – Philadelphia Schools, Pennsylvania Regional
Sarah Waters – NOAA Thunder Bay, Great Lakes Regional
Ike Coffman – Humble CATE Center, Texas Regional
Lisa Spence - NASA, Texas Regional
Cathy Sakas- NOAA Grays Reef, Southeast Regional
Caroline Joyce - Great Lakes Water Institute, Wisconsin Regional
Tom Consi - UW Milwaukee, Wisconsin Regional
Don Poland - Academy for the Arts, Sciences & Technology, South Carolina Regional
Sherry P.- St.John's Newfoundland, observing
Dwight House – Memorial University, Newfoundland & Labrador Regional
Ashley DeLong,- Nova Scotia Community College, Nova Scotia Regional
Candiya Mann- UW, MATE Center evaluator
Deidre Sullivan- MATE Center, Director
Cindy Fong- Hilo Intermediate School, Big Island Regional
Peter Leighton- Nauticus, Mid-Atlantic Regional
DeDee Ludwig - Shedd Aquarium, Great Lakes Regional
Scott Fraser - Long Beach City College, Southern California Regional
Fritz Stahr - University of Washington, Pacific North-West Regional
Matt Gardner, MATE Center, Monterey Bay Regional

Three new regionals here – Pennsylvania, South Carolina and Wisconsin

## General Competition Topics

**Item 1**: (Jill)

A brief history of the ROV competition – partnership with MTS ROV Committee who came to MATE (~2003) to help get skilled students into the stream, focused on ROVs as a vehicle - good summary power point – 7000 students middle schools to college – 18 regionals now (15 last year), 100's of working professionals, not all about missions and technology but also communications & documentation & project management, students moving on noted that - unfortunately mostly anecdotal evidence for long-term effects of how successful competition is (thus Candiya & evaluation now).

**Item 2**: (Jill)

A debrief of the 2009 International ROV competition. Overall- it went well noted that there is always a demand for information earlier. This especially relates to: housing, ROV shipping, etc. Noted- at each venue this information is dependent on host venue so where there's good management (e.g., UH-Hilo conf staff) information will be faster, Weather was a competition issue for the first time in Massachusetts– bad thunderstorm (unusual & bad summer) but all safe & survived.

**Item 3**: (Matt)

The 2009 props had a few Ranger-class issues. Regional coordinators (RC) or prop builders may think 1/2 cm doesn't matter in building, but there are teams/students that rely on those exact figures. He noted that if RC cannot get parts- he can get parts needed if necessary and ship them out. Matt noted the RC's requests for more recycling of old props and prop parts like tarps, anchors, etc.

Lisa noted that other RCs who build props should place emphasis on following photos because sometimes there are interpretations based on things. Meghan says her 8 school districts share props materials due to funding, Cindy says they make 3 sets early and spread around island then used for competition. Erica notes that often students want to be at a specific pool depth. She also noted that sometimes even Home Depot parts aren't same coast-to-coast so use Matt's measurements and numbers. Erica also noted, don't wait until last minute to build because then MATE can't help so easily. Staff noted: don't forget to prepare any Regional teams for differences between regional and international, issue re: depth of pool being much shallower than "up to 12' deep", in HI it will be 4.5-6.5' deep, make it a point of it at your workshops or on your Regional webpage.

Positive things from 2009 events: all teams busy for 15min, only one time bonus (can't finish is good for making sure real differences in scores) – Cindy welcomes all to Hilo for Hawaii event – hotel info already out (get discounts if you want now), not enough dorm space at UH-Hilo but looking for other dorm space nearby, Cindy suggests folks can rent a house, trying to get arrangements for shipping, Cindy offers woodshop at school for teams to help build/re-build.

Audience suggestions of making a "mystery prop" and add trophy for being able to adapt to, Ashley had mentors have a debate on night of event due to different transfer skirt, etc. so now all communications at her event go through regional coordinator, semantics sometimes an issue & verbal descriptions. RCs noted that Jill sends out listserv emails to coaches/mentors but doesn't get always get to students, but now will be on Twitter & Facebook so students will get it quicker and more directly.

**Item 4**: (all)

Cathy noted her regional started small, but got a burgeoning number of teams and found competition fervor ramped up to high level and teams get more bellicose. She noted a need for standardization and that we must beware of cheating (e.g., score sheet cheating) so put in mechanism for that (e.g., directly transferred sheets, multiple methods for recording scores) Ike and Cindy do this too. Their teams don't get to see scores until final; also if teams become rude or disrespectful then they can get kicked out.

Meghan: how to equalize scoring for engineering evaluation & pool judges?
Cathy gets all her judges together before with sample ROV video (Erica makes on You Tube with ROV Malakai) and decided on scoring for pool judges.

Cindy used to do same, Dwight has all of his judges do evaluation 1st on one sheet together and then explain before separating. Fritz suggests keeping experienced and new judges on teams together and then be sure to give time at end of day before awards to equalize subjective issues. Jill noted that she always has a pre-event meeting, and is looking to get spreadsheet to normalize engineering evaluations & technical reports & posters across judge-teams, post-evaluation conferences between judges. Some missions also require us to use divers as judges/referees to assist pool-edge judges. The issue of changes to poster score sheets to have grey area between 0/1 items ok? Yes but make sure to pass on to MATE (Deidre) and Fritz says make sure to get that spread around to all judging teams, make sure multiple missions run on not same stations (4 in parallel, 2 x each), if need some experienced people MATE can help, Cathy suggest prep judges to be professional, but remind them to have fun and if necessary tell mentors to sit-down, back off, etc. and note that all human

Dwight re: broadcasting underwater video for spectators on large screens, multiple cameras, Tom suggests webpage for cell-phones with live video feeds from underwater cameras.

Tom – do graduated students make good judges? Yes & also make good mentors as well especially for younger students, Cindy makes it part of deal of supporting college teams, HS, etc. Matt notes don't let HS judge his own HS or college, Scott had students put in roles of judges due to lack of others, teamed with archeology student volunteers, and on tech evaluations.

**Item 5**: (Matt)

Matt previewed the 2010 missions: focus on Loihi seamount (new undersea volcano making new island) – same idea of one 15 minute total time to execute mission and give teams 2 trials.

First mission to resurrect HUGO (HI underwater geological observatory), so plugging things into it etc. 1) pull pin to release hydrophone, 3 stations where 1 makes noise (battery w/RadioShack buzzer & battery) so ROVs will need device to hear – simple hydrophone w/ headsets will have resources on MATE site - find which making noise, then move that hydrophone to elevator (hydrophone is last year's ESS pod – yeah!) also using the airline insertion point as "plug", J-bolt for release pin, flat plastic for sheet with hole in it for plug, have divers change location of noise makers,
Tasks can be done in any order, 4 overall missions. Second will be to retrieve sample of bacterial mat with sediment core with agar in plastic container – push core of bowl of agar, scoop, can't just grab whole thing!, no detail of how much yet (displaced volume) but will get it figured out – must bring it back to surface (judges have beaker to measure) – Scott tested in various things in sun & pool and ended up getting it at bulkfoods.com (dry mixed up), will need to fill one per team per trial, velcro'd to bottom, hold down base-plate with rocks, weights, etc. Third will be a new species of crustaceans – glow-in-the-dark fishing lures/worms – cave to go into (opening of ~80cmx80cm, 2m deep, a bunch on wall to be collected by ROV, points for # recovered (use plastic/tarps from previous years with backside that divers can quickly reset, backend of cave is hard but rest is tarps/plastic/landscaping material (e.g., mystery reef from 2004 Santa Barbara), advice is that most ROVs will need to be small (some may be large with 2m arm?), some darkness but not specified. Final or fourth part of mission will be a temp sensor of vent like in 2008, but maybe not have Ranger class report # but rather hotter or colder than normal, probably make it cold

like at International. Teams will need to show judges a temp spike or dip, not just a guess, Explorer will need actual #, and sample part of vent (e.g., 2008 vents) with cement base – shorter to accommodate shallow pool, draft out in mid-November (need to hammer out shortly).

Tom suggests requirement of taking data and making plot to hand judges – Matt, have discussed but worried re: timing, enough? – tested some ideas out at upcoming Intermediate Summer institute, increasing computer requirements of activity – rapid turn-around, Don suggests 2 stations so teams can have 2nd trial be different, Cindy suggests pilot trials from experienced folks around table.

## Best Practices

**Item 1**: (Erica)

Best practice from FL: have some sort of tradition with your judges and volunteers. This is also done in Monterey. Recognize that your job of regional coordinator doesn't end with the end of your event, but that you really need to help winning team(s) help get to International. Help them with paperwork, travel, etc. group air-tics for lower fares Lisa – mentor students and help them with elements not done at your regional competition. If your regional has no poster session- help your winners to get going on their International event poster.

## Issues, challenges, and sustainability

**Item 1**: (Jill)

A Regional issue of teams at some distance get to go to International without going to a Regional– no teams can go to 2 regionals. This year had team from school in Michigan and wanted to go to Shedd Aquarium regional but should have gone to Mid-west regional – various reasons related to travel then allowed going to Shedd so Jill allowed. Mentioned issue with Andrew Kay going to Monterey vs. 1st year at PNW – grant in place so that team used money to go to Monterey instead of PNW. Ike added that he always talks to teachers re: Science Olympiad and state Technology Student Association (TSA), now MATE ROV counts as points for TSA sanctioned event, but can't work around infinite number of other school related events (e.g., proms, spring break), Meghan suggests Skills-USA competition (engineering design presentations), teachers & principals appreciate opportunity to feedback and select date, Cathy wants to emphasize success with Interstate batteries.

**Item 2**: (all)

Velda – liked news of help from Interstate Batteries and wants more info, especially regarding pools. Velda shares her ROV and robotics information to all manner of events – First, Best, SeaPerch, etc. Cindy asked for help with getting certificates of appreciation – standardized from MATE and space for local logo & signatures on those certificates. Jill noted the use of a calendar for thank-you's. She can provide these as use for sponsors – can make extra copies for sponsors.

Marcel joins group- completed high school outreach program at OCEANS Conference– 6 groups of ~35 for ~18min each in 2 portable pools, news crew came out from local channel, kids being interactive with ROV kits, <talk to re: Oceans2010 for same>

Meghan offers a late afternoon session before her regional event for practice. There judges help with comments, questions, etc. (2hr meeting) – she had NSF grant to provide bussing to pool – more information on her grant – new marine tech program at her CC that allowed for such – she suggests getting kids in front of school committees to ask for financial aid.

Cindy suggests inflatable pools for getting wet or feed troughs (horse-troughs) – buoyancy, waterproofing testing.

Cathy made error of thinking her supervisor could hook up battery but did wrong and had an explosion, so be sure to designate a safety person at your event. Also several RCs noted- don't give yourself a job at your event if you are the coordinator . Also wear something visible so folks can find you on the pool deck. Dwight noted that he puts diode & LED, or fuse-able link for quick blow before explosions on his batteries.

Caroline asked about insurance, forms and coverage. MATE can help with Insurance Events (done for FL, PNW, Monterey), does have hold-harmless agreement, etc., media releases also for pictures in newsletters, etc.

## Regional Coordinators Handbook

**Item 1:** (Jill)

Jill thanks all for comments - very impressed
This is our document and living so keep adding – (should have revisions soon)
Lisa has color-coded to-do lists and spreadsheets – willing to share (likewise Monterey, PNW)
Pre-competition info well in advance for location, etc. – keep in communication with all coaches/mentors –
Don suggests lists/spreadsheets, etc be added to this as appendices
Jill will incorporate current comments and put new version on Google docs
Erica suggests section on sharing fund-raising ideas – Jill notes "team-only "area of website which includes Fund-raising 101 and potential sponsor letter available now – can add there – Erica says ask large company to support competition first before teams go to them for team donations so logo on your Regional web-page.
Meghan suggests getting students to host booth at professional teams – most allow such for fund-raising.
Sherry suggests adults/teachers/coaches help do – also ask sponsor what they want in return – video (put on large screen between underwater feed from – auto-ppt)? Buy material? Banners?
Opportunity to speak at opening, closing? Get into budgeting cycle for 2 yrs out,
Cindy asks re: using a 501c3? – yes local MTS section or IEEE section, or through MATE center,
Take ROV to farmer's market to let folks fly for 5min for $5 – raised $1000 in one Saturday (like SeaTech with 4H shows)
Sherry suggests inside school ROV naming rights & demo-day to raise $
Meghan hosts National Engineering Day at CC and ties into that
Scott students accept donation to ROV foundation and puts stuff on EBay to raise money, has raised $35k,
At fair – put can of soda or beer into tank and let people try to get can off bottom for $1/min. (Scott)

# ITEST

**Item 1**: (Jill)

ITEST (Innovative Technology Experience for Engineering Students and Teachers) grant – funding support only to 12 regionals at present (though now have 15 regionals) maybe can get additional funding. <ITEST under DRL, funded by H1B visa fees as shouldn't be importing engineering talent> All about bringing students from middle-school up in marine tech milieu. MATE focused on CC level, then did ROVs for both college and HS, and now finding more middle-schools coming on board but couldn't target for development due to MATE grant restrictions so this to benefit whole competition. Jill showed some slides from Oceans talk and passed out crib notes we discussed on phone several weeks ago. What we want at end of 3 years is that all regionals have scout-class competition and support structure to go along with it (e.g., workshops for teachers, students, etc.) Conference call to organize first few groups (SoCal, PNW, NE, FL)
Cathy questions: Scout class goes on to Intl? No but maybe later. Do schools competing in Scout class count toward requirement for sending more Ranger teams to Intl.? No as really this is to limit Ranger teams. Ike says he'll have Scout class in March and if good will be invited to Ranger class (like Vancouver.) Cindy restricts Scout ($4^{th}$- $8^{th}$ grade) to 2 hrs only before Ranger competition then sends them to watch. Jill gave a quick explanation of Scout vs. Ranger classes – Scout is no camera, simple pick-up tools, 7.5A limit, so motors are small and don't need water-proofing per-se (need rinse, dry, silicon oil post immersion), Erica says bilge pump motors ~$11/ea for bulk but small electric ones are ~$4/ea. ,
Jill talked re: $ distribution, $7k salary/yr, $4200 participant/yr, $1450 1-time equipment, 10 free ROV kits, $1k travel
Peter suggests ROV kits as corporate team-building exercises & some of the $ goes to support competition.

**Item 2**: (Candiya)

Evaluation for ITEST & MATE center -
More than just process evaluation (#s) – broader goals re: are teachers gained?, what did students gain?, what have parents gained? – so we are getting both of these surveys to gather information for use in improving programs and for NSF. Because of time burden wants to make this easy so now drafting survey protocols despite implementing differently. << NEEDs to speak with each regional coordinator setting up for 2009 re: draft surveys >> Wants standardized protocol so can make latitudinal study. Data collection is student surveys (pre-post competition), parents (only competition), and teachers/mentors/coaches (pre-post workshops and competition). Candiya is looking for specific information from regions to help evaluation of survey success. Question re: different languages? Yes, working on Spanish for Parajo valley – Meghan needs in Haitian creole – will be good for report. Teacher surveys are quick and simple – 3 & 5 questions. Competition surveys more complex but want good response rates so multiple mediums (paper & online). Jill noted that idea for parents came from them opening workshops to parents and now retention rate much higher. Jill will send some papers re: engaging parents.

Jill re: Monterey implementation of ITEST – using Extended Learning program of Parajo valley schools and they provide teacher salary extension and MATE brings in tools and volunteers to support – had to go to schools,

Meghan re: NE – worked with urban centers with low graduation rates – New Bedford has Citizen School program after school – already approached last year, now has 30 middle-schoolers already in program with college students – passed around Apprenticeship lesson plan outline - teacher training on Dec 5th – other program, Fall River, and Upward Bound (HS) & Talent Search (mid-S) and large population of Cambodian and Vietnamese community – additional teacher trainings in Jan and Feb vacation <could do in PNW as have same vacation sched>.

Deidre asked for us to video tape – get cheap camera positioned in corner of room to share techniques such as this – already done for Meghan's teachers/students, website is bccsmart.com - see all student info, outreach activites including quidich tourney, ROV competitions, etc.
Cindy – can't get at YouTube but can get to teacherTube – this is a nationwide issue.
Scott will have ROV in Aquarium of Pacific in major fish tank – video feed to local children's hospital – lots of response from parents
Meghan gets to teachers by getting parents interested at fairs - <<use SeaTech?>>

Next year will do this for whole day at MATE in July after beginner level summer institute which this year's middle school teachers can attend.

End 5:25pm

**Members of the MATE ITEST Project's Curriculum and Cultural Advisory Committee**

- Jenny De La Hoz, Community Partnerships Program Manager at the Monterey Bay Aquarium (MBA)
- Kimberly Swan, former middle school classroom teacher and current Teen Programs Manager at MBA
- Cindy Fong, science teacher at Hilo Intermediate School
- Pascale Pinner, teacher-in-residence and grant writer at Hilo Intermediate School
- Katie Welsh, Associate Professor in the College of Education at the University of Wyoming whose focus areas are multicultural and K-8 math and science education
- Céleste Frazier Barthel, Science Connections Coordinator and Ph.D. candidate in the Department of Science Education/Geosciences at Oregon State University


# ITEST Advisory Committee
# Pre-meeting Webinar
# Friday, March 5th @ 11am PT

# ITEST Advisory Committee

- Celeste Frazier Barthel, Oregon State University
- Cindy Fong, Hilo Intermediate School
- DeDee Ludwig, Shedd Aquarium
- Jenny De La Hoz, Monterey Bay Aquarium
- Kate Welsh, University of Wyoming
- Kim Swan, Monterey Bay Aquarium
- Pascale Pinner, Hilo Intermediate School

# Other people on this call

**Candiya Mann**
Washington State University, MATE & ITEST evaluator

**Deidre Sullivan**
MATE Center Director & ITEST Co-PI

**Erica Moulton**
MATE Summer Institute Coordinator & ITEST Co-PI

**Jill Zande**
MATE Associate Director & ITEST PI

# Purpose of this webinar:

**To help us to prepare for our face-to-face meeting by…**

- Providing background information about the MATE Center's ROV competition program, a cornerstone of the ITEST grant
- Reviewing the ITEST proposal and providing details on the specific grant activities, including the work done so far
- Informing you where we need your help
- Assigning "homework"
- Answering your questions

# MATE ROV Competition

- Partnership with the MTS ROV Committee
- To date, has involved more than 7,000 students in grades 5-16
- Includes one international competition and 19 regional contests held across the U.S. and in Canada, Hong Kong, and Scotland
- Involves 100s of working professionals & organizations
- Includes underwater missions, technical reports, presentations, and poster displays
- Is encouraging students to pursue degrees in engineering, science, and technology and eventually to get jobs in the field
- Is a great way to teach science, technology, engineering, and math as well as teamwork, critical thinking, and problem-solving

# ROV Competition (cont.)

- The theme changes each year in an effort to expose students and teachers to the many different aspects of the ocean workplace. Themes have included:
  - Exploring the *Titanic* (partnered with Walden Media and James Cameron's *Ghosts of the Abyss*)
  - Polar science and technology (in recognition of the International Polar Year)
  - Submarine rescue (with assistance from OceanWorks International and the U.S. Navy's Deep Submergence Systems Office)

- The international competition venue also changes each year. This gives students and teachers opportunities to experience different parts of the world and gain access to premier university, government, and industry facilities, such as:
  - Massachusetts Institute of Technology
  - NASA Johnson Space Center's Neutral Buoyancy Laboratory
  - Canada's Institute for Ocean Technology


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IEEE
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Chevron
Princetel
Marine Technology Society Houston Section
Newfoundland Labrador
subsea 7
VEOLIA ENVIRONMENTAL SERVICES
ASI Group
OceanWorks International
SCHILLING ROBOTICS
ARCADIA
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DEEPSEA POWER & LIGHT
Marine Technology Society Monterey Bay Section
SEA TECHNOLOGY
PARALLAX
DESERT STAR SYSTEMS
SolidWorks
PHOENIX INTERNATIONAL
GRI SIMULATIONS INC.
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COAST The Coast Distribution System, Inc.
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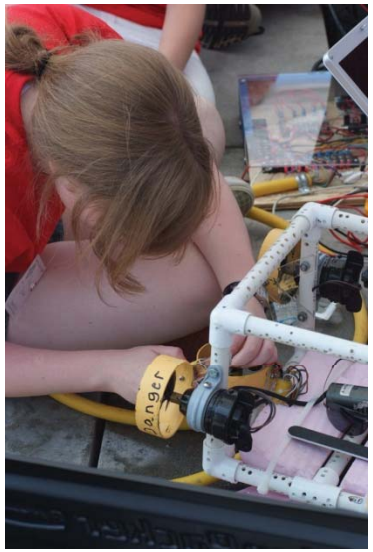
NAVSEA
ALLIANCE FOR COASTAL TECHNOLOGIES
VANTEC
OIC OCEANIC IMAGING CONSULTANTS, INC.
MARINE TECHNOLOGY SOCIETY
THE HAWAII SECTION OF AN INTERNATIONAL OCEAN & MARINE NETWORK

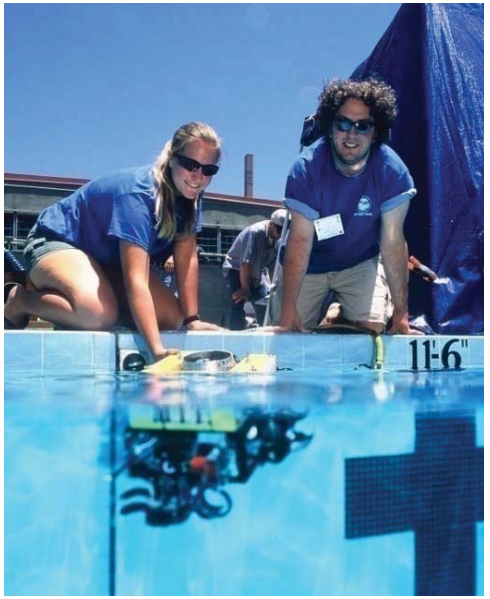
# Competition structure

The competition is divided into 3 classes:

- *EXPLORER (advanced)*
- *RANGER (intermediate)*
- ***SCOUT (beginner)***

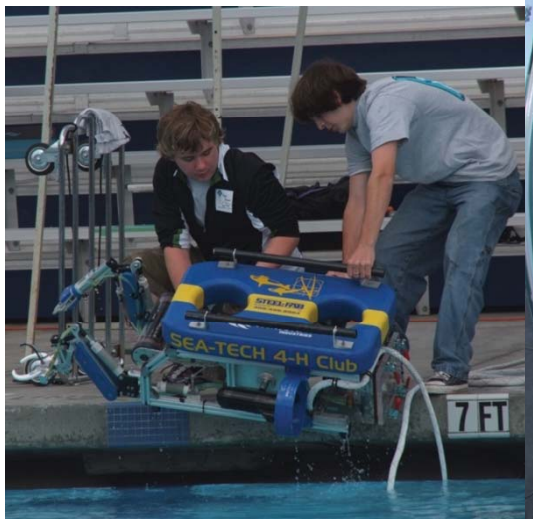





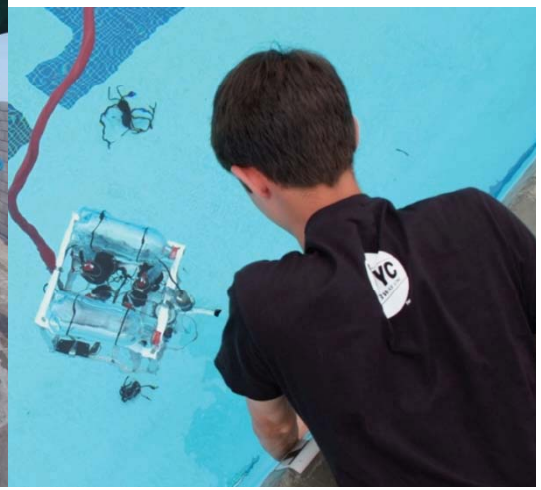


# OCEAN CAREER EXPO

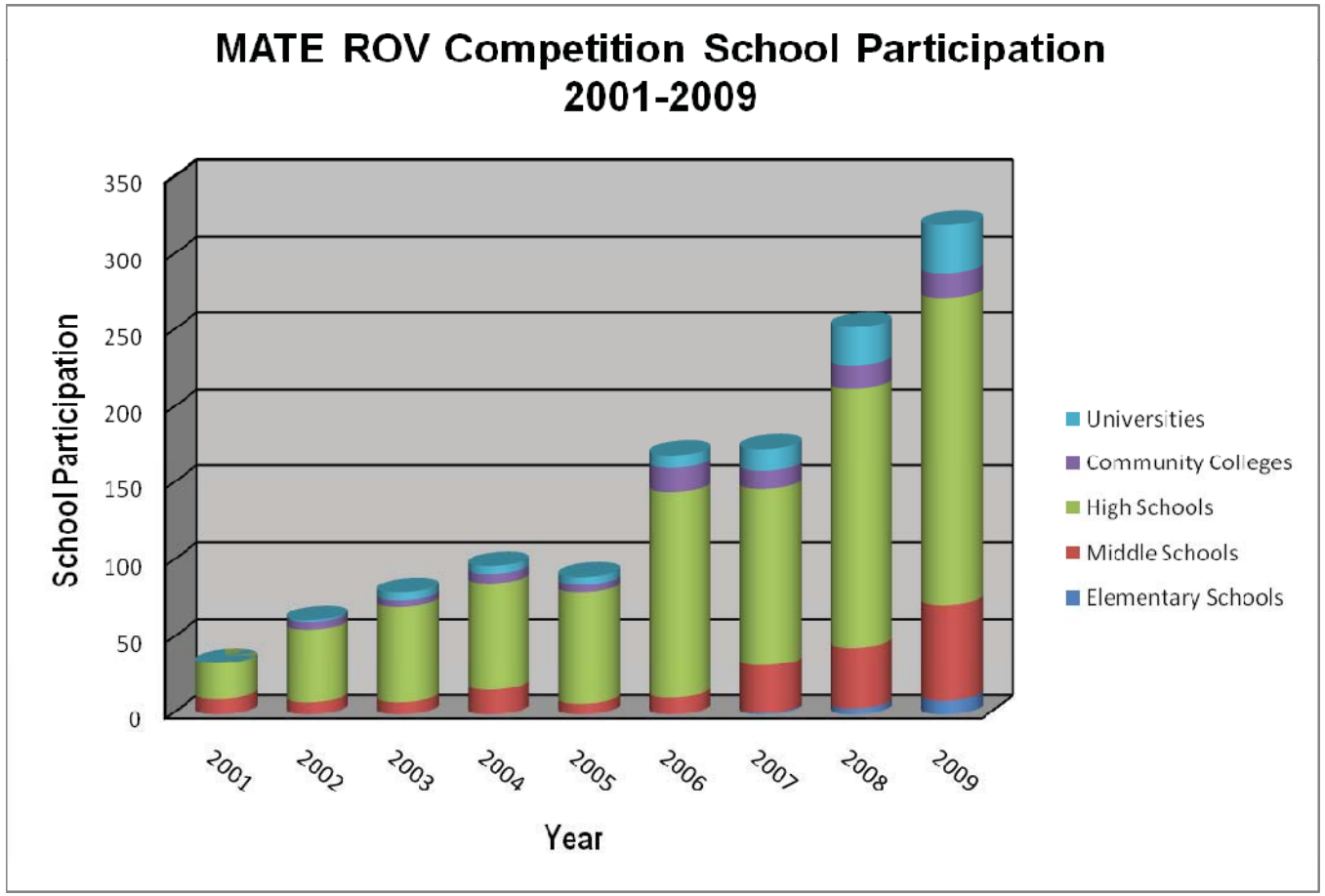
- Employers that sponsor the competition are invited to participate
- Students submit resumes that are circulated in advance to employers
- Employers target students in whom they are particularly interested
- Students also post resumes to MATE's AlumniWeb and employers are given password to access the resumes







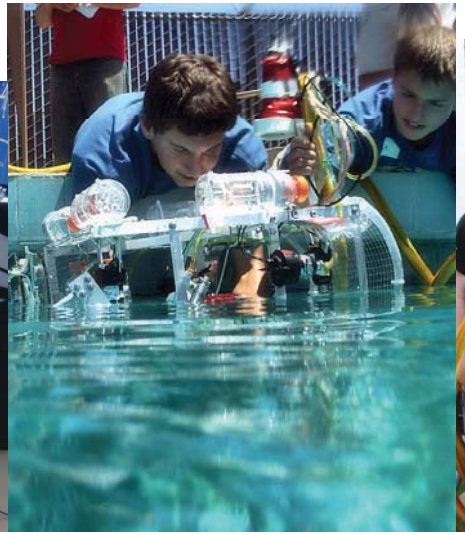
# MATE ROV Competition



# Innovative Technology Experiences for Students and Teachers (ITEST)

## *MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce*

- $1,199,903, 3-year project funded through ITEST/DRL/NSF
- Overarching goal:  Use the MATE ROV competition as an engaging platform to prepare middle and high school students for careers in the ocean STEM workforce.

# Objectives

1. Build the support infrastructure for an entry-level ROV competition class by a) providing professional development and student support workshops in after-school and informal settings; and b) developing, adapting, and enhancing ROV-focused STEM curriculum materials.

2. Increase ocean STEM career awareness and present trajectories to those careers for middle and high school audiences. (*Exploring Ocean Careers* & OceanCareers.com)

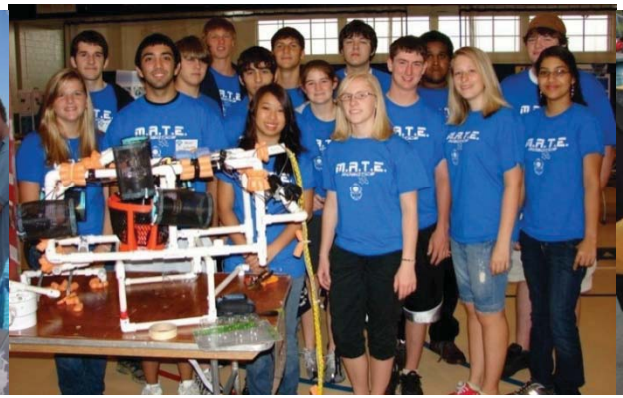
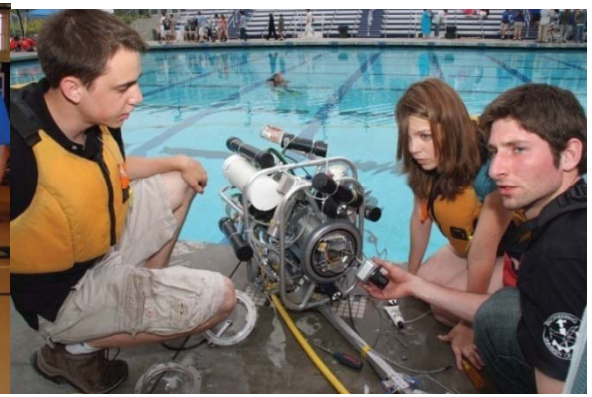
3. Build a cyberlearning center to a) foster collaboration and increase communication among students, educators, parents, and working professionals; and b) improve access to STEM instructional resources. ("ROVER")

4. Evaluate and track project participants to determine the impact on a) students' STEM knowledge, skill development, and inclination to pursue STEM education and careers; and b) teachers' confidence in facilitating STEM learning experiences and delivering career information.

# SCOUT class structure & support

Each MATE regional will use its local resources and expertise to provide:

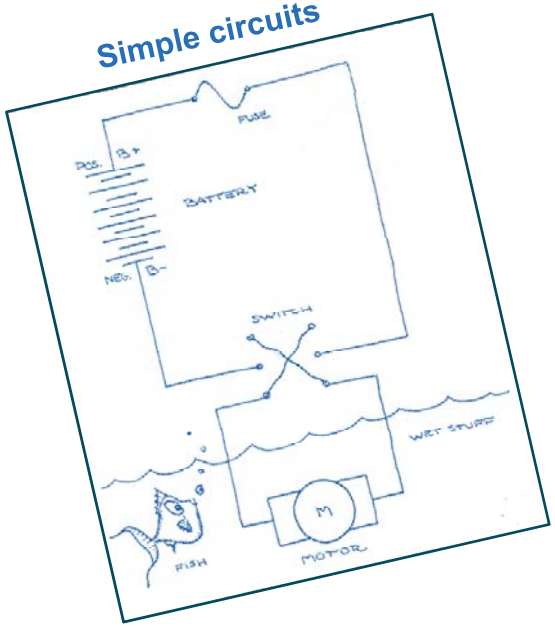
- Professional development workshops where teachers leave with an ROV
- Hands-on experiences for students
  - Topic-specific workshops, such as wiring and waterproofing techniques
  - Engineering reviews by professionals from the industry
  - Pool practice days with technical support “staff” available to assist
- Building materials, supplies, tools, and equipment
- Access to mentors, including high school, college, and university students

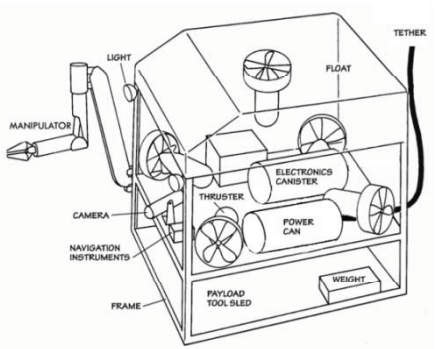
# SCOUT class structure & support (cont.)

- Curriculum materials
  - Modules adapted from MATE's upcoming textbook, *Underwater Robotics: Science, Design & Fabrication*
  - "Course" outlines and other project management resources
  - Hands-on activities that demonstrate key concepts
  - PowerPoint presentations and videos

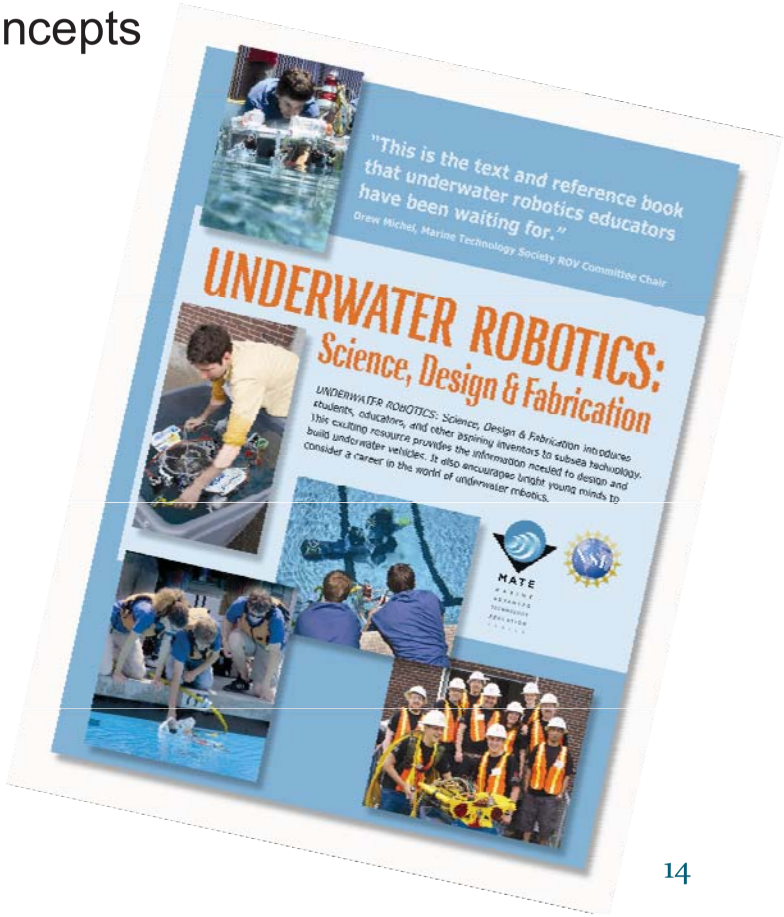
**Simple circuits**




***ROV Anatomy 101***




**Archimedes Principle**



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# CAREER PROFILE OceanCareers.com

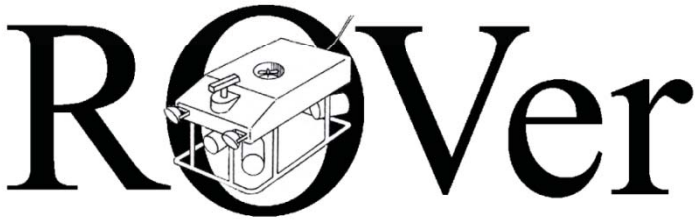
- Sales Associate ($16K)
  - Enterprise Rental Cars
- Monterey Peninsula College
  - Associate degree in Marine Science and Technology
- Internship
  - Harbor Branch Oceanographic Institute
- Oceaneering International
  - ROV technician ($45K)
- Intensive electronics training
  - Oceaneering International
- Oceaneering International
  - ROV Supervisor ($100K)

**Stanford Leon** is a Remotely Operated Vehicle (ROV) Supervisor for Oceaneering International.

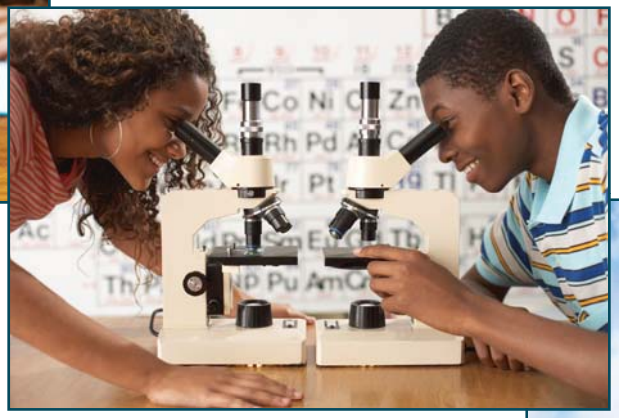
# ROV Education & Resources

***The one-stop location for ROV-focused STEM information, resources, and communication tools***

- **Mentor Hotline**, a geo-referenced directory of working professionals and the "services" (design reviews, tours of facilities, etc.) that they offer
- **Communication Hub**, a multi-faceted discussion area that includes links to Facebook, Twitter, YouTube, and more.
- **ROVing 101**, the repository for MATE-developed materials as well as links to outside resources.
- **ShareWare** where teachers, students, and industry professionals can share curriculum materials, sources for parts and pieces, photos, videos, and more.
- **ROVER tutorial** to assist users in understanding and navigating their way through the resources and "social cyberspace."



# Evaluation



***Have we made a difference?***

# QUESTIONS?

# Objective 1

**TIERED IMPLEMENTATION APPROACH**

- Year 1: Monterey, Southern CA, Pacific Northwest, New England
- Year 2: Hawaii-Oahu, Hawaii-Big Island, Texas, Mid-Atlantic
- Year 3: Florida, Southeast, Great Lakes, Midwest

**EACH REGION RECEIVES**

- Funding
  - Stipends for salary
  - Participant support
  - Materials to set up their workspaces
- ROV kits
- MATE's current collection of curriculum materials, which includes ppt presentations

# Activities to date

## New England

- Target audience – urban Hispanic/African American, socioeconomically disadvantaged
- Student and teacher workshops
  - BCC engineering students as mentors
- SCOUT class planned as its own contest

## Pacific Northwest

- Target audience – rural, socioeconomically disadvantaged
- Visits to schools to promote the project
  - University of Washington engineers and technicians present
- Teacher workshop
  - Schools apply for funds to support purchase of building materials
- SCOUT class planned as part of the existing regional

## Southern CA

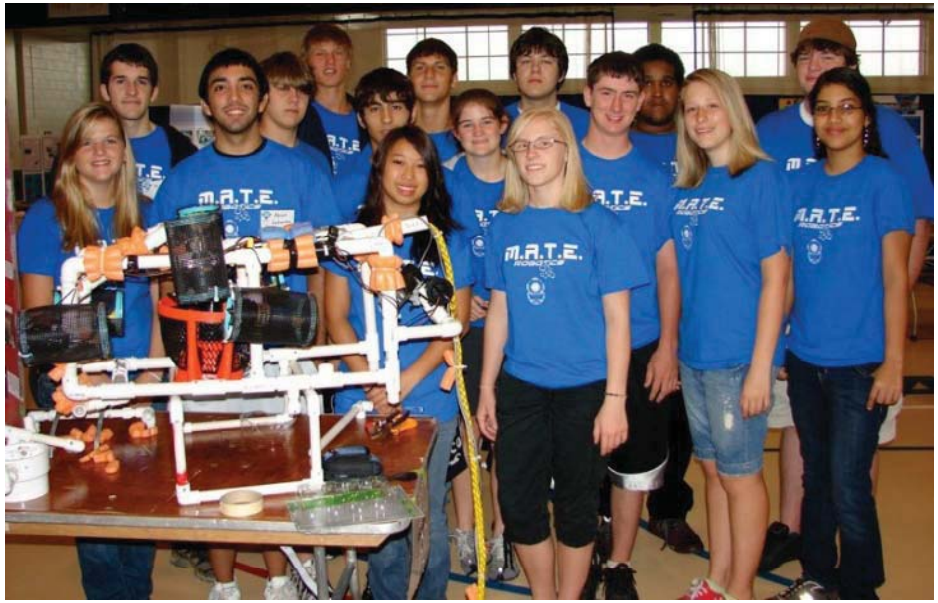
- Target audience - urban Hispanic/African American, socioeconomically disadvantaged
- Connection made with LBUSD and LBCC Tech Prep
- Teacher workshop
- Team pool practice days
- SCOUT class planned as part of the existing regional

# Activities to date

## Monterey

- Target audience – Hispanic, socioeconomically disadvantaged
- Existing SCOUT class support "system" and contest
  - We knew that we needed to do things differently!
- Connections made with PVUSD and MPUSD after-school (or "extended learning") programs
  - 5 MPUSD middle schools
  - 1 PVUSD K-6 school
  - 1 PVUSD middle school (and interest from others for next year!)
- Teacher workshops
  - Workshop for middle school teachers in November
  - MPC's Tech Prep program funded a workshop for high school teachers in January
- Teachers implementing the ROV project as after-school "course" that meets 2X per week for 6-8 weeks
  - Volunteers visit schools to help
  - "Fly-off" will send the winner to the Monterey Bay regional
- SCOUT class is part of existing regional

# QUESTIONS?



# Advisory committee meeting

## March 15-16 @ the Monterey Beach Hotel

**GOAL:** To define an effective approach to 1) curriculum development and 2) career guidance that will meet the needs of our target audience.

**TARGET AUDIENCE:** Underrepresented middle school students. We use the term "underrepresented" to refer to gender, ethnic minorities, socioeconomically disadvantaged, and/or rural populations.

**KEY QUESTIONS:**

- Do we create our own signature MATE curriculum or compile a collection of existing resources that we tie together with a "MATE" overview and examples of how they relate to designing and building ROVs? Either way, what should it look like? Hard copy? DVD? Are complementary materials (e.g. ppts) posted on ROVER?

- How do we modify and adapt our careers course so that it appeals to middle school students and is accessible and "easy" for middle school teachers to implement in the classroom or assign as "self-study?" Where do parents fit in?

# Advisory committee meeting (cont.)

**OUTCOMES:**

- A collection of best practice strategies, programs, events, curricula, products, etc. for reaching and engaging underrepresented audiences (including their parents) that we can learn from and share across the network.

- Answers to the key questions that include the following:
  - A straw-man curriculum
    - What are the key elements that our curriculum should include?
    - Which best practices should we adopt to ensure that our materials/activities are engaging to underrepresented audiences?

  - Recommendations for adapting and improving career information from the *Exploring Ocean Careers* course and the Ocean Careers web site so it is engaging to our target audiences.
    - How do we appeal to parents in the process?

# Advisory committee meeting (cont.)

**"HOMEWORK:"**

- Review curriculum examples (Jill to send electronic files or links):
  - Current MATE materials
  - Shedd Aquarium *Underwater Robotics for After-School Science Clubs*
  - SC ATE *Technology Gateway Instructor Guide*
  - Sea Perch

- Visit www.OceanCareers.com and review the course by:
  - Visiting http://ilearn.mpc.edu/course/category.php?id=11
  - Selecting MAST 31 EXPLORING OCEAN CAREERS FALL 09 SEC. 0648
  - Login as
    - Username: mpcguest
    - Password: student

- Bring with you (and/or send to Jill in advance to copy):
  - Examples of "model" curriculum ("model" because of content, presentation, and/or popularity)
  - Strategies for reaching and engaging middle school students/underrepresented audiences

# Advisory committee meeting (cont.)

**LOGISTICS**

- March 15-16 @ the Monterey Beach Hotel
- Pick-up at Monterey Airport OR take a taxi

**AGENDA**

Detailed agenda to come, but in general:

- Monday, March 15th 8:30am - noon (lunch) then 1:00pm - 5:00pm with a dinner at 6:30pm

- Tuesday, March 16th 8:30am - 12:30pm (lunch) then MBA visit for those interested

**STIPEND & REIMBURSEMENTS**

- $500 for participating in meeting
- Save receipts for out-of-pocket expenses

# QUESTIONS?

You can always contact me at:

Jill Zande
MATE Center
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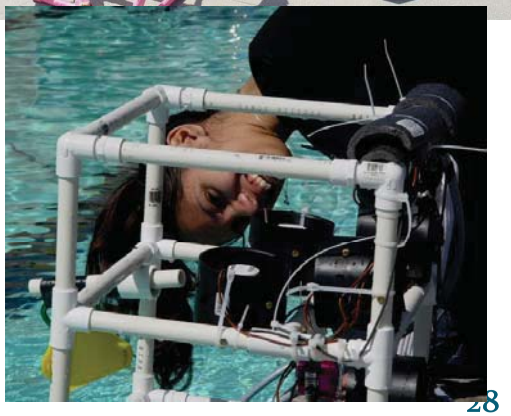
Monterey, CA 93940
jzande@marinetech.org
(831) 646-3082

***See you in Monterey!***



# ITEST Advisory Committee
# Monterey Bay Beach Hotel
# Captain's Table
# March 15-16, 2010

## MEETING AGENDA

## SUNDAY, MARCH 14th

Arrival:

- Candiya – San Jose International Airport, 5:47pm
- Celeste – Monterey Airport, 11:15am
- Cindy – San Jose International Airport, MARCH 13th, 9:00pm
- DeDee Ludwig – Monterey Airport, 12:50pm
- Erica – Monterey Airport, 8:30 pm
- Jenny – local
- Katie – Oakland Airport, MARCH 12th, 2:09pm
- Kim – local
- Pascale – unable to attend

Those arriving in Monterey, please plan on taking a taxi from the airport to the hotel, which is located at 2600 Sand Dunes Drive, Monterey. Please get a receipt – MATE will reimburse you!

Dinner on your own/coordinate with others (MATE will reimburse)

## MONDAY, MARCH 15th

**8:30am** – breakfast in Captain's Table room

Breakfast includes eggs, granola, yogurt, fruit, breakfast breads, juice, coffee, tea

**8:45am** – Welcome and introductions (continue eating!)

**9:00am** – Recap from pre-meeting webinar, discussion of meeting outcomes

Key questions:

- Do we create our own signature MATE curriculum or compile a collection of existing resources that we tie together with a "MATE" overview and examples of how they relate to designing and building ROVs? Either way, what should it look like? Hard copy? DVD? Are complementary materials (e.g. ppts) posted on ROVER?
- How do we modify and adapt our careers course so that it appeals to middle school students and is accessible and "easy" for middle school teachers to implement in the classroom or assign as "self-study?" Where do parents fit in?

**9:30am** – Curriculum development discussions

Questions to stimulate discussion:

- What's (format, content, etc.) is most helpful to teachers either delivered in a classroom setting or afterschool, as our program is structured?
- Review our current materials

    - What's good?  What's not?
    - MATE's textbook – how can we best utilize it?

- Review other examples of what's currently out there (your "homework" from the webinar)

**10:30am** – BREAK

**10:45am** – Continue curriculum discussion

**12:00pm** – Lunch in the hotel restaurant

**1:00pm** – Continue curriculum discussion

**2:30pm** – Engaging underrepresented audiences

Activity and discussion

**3:30pm** – BREAK (cookies!)

**3:45pm** – Strategies for engaging underrepresented audiences

What works for…

- Students
- Parents
- Teachers

**5:00pm** – Finished for the day

**6:15pm** – Meet in the lobby for travel to the Monterey Fish House

## TUESDAY, MARCH 16th

**8:30am** – breakfast in Captain's Table room

Breakfast includes eggs, granola, yogurt, fruit, breakfast breads, juice, coffee, tea

**9:00am** – Team-building exercise

For our benefit as well as to share with teachers!

**9:30am** – Career information (with a focus on underrepresented audiences)

Questions to stimulate discussion:

- How is career information currently received and interpreted by students and, perhaps more importantly, their parents?
- What are the best strategies for presenting and delivering career information to these audiences?
- How should these strategies drive our work on the careers course and web site?
- How should these strategies influence the adaptation and modification of existing career information and practices?

**11:30am** – Wrap-up and next steps

**12:30pm** – Finito!

**1:00pm** – Meet in the lobby for travel to the Trailside Café for lunch

**2:00pm** – Depart for Monterey Bay Aquarium

**Dinner on your own (MATE will reimburse)**

## THANK YOU AND SAFE TRAVELS BACK HOME!

## Katie's notes and resources

### Summary of resources discussed at Monterey Meeting Day 1 3-15-10

**CMAP** http://cmap.ihmc.us/conceptmap.html

Loucks-Horsley, S., Love, N., Stiles, K., Mundry, S. & Hewson, P. (2009). **Designing professional development for teachers of science and mathematics** (3rd ed.). Thousand Oaks, CA: Corwin Press.

National Academy Press report on **Learning Science in Informal Environments** (http://www.nap.edu/catalog.php?record_id=12190). Also check out the **Surrounded by Science:** Learning Science in Informal Environments (http://www.nap.edu/catalog.php?record_id=12614).

**National Content Standards** www.corestandards.org

**National Science Education Standards 5-8**
http://www.cnr.berkeley.edu/citybugs/teachercorner/standards/nationalstandards5to8.htm

**National Staff Development Council Standards** http://www.nsdc.org/standards/index.cfm

Yager, R. (Ed.) (2005). **Exemplary science: Best practices in professional development.** Arlington, VA: National Science Teachers Association

Note from 3-15-10 discussion: Make sure to check out the College and Career Readiness standards in the Literacy Standards...http://corestandards.org/

### 3-16-10

Bransford et al (2005). (2000). ***How people learn: Brain, mind, experience, and school (expanded edition)***.Washington, DC: National Academies Press.
http://www.nap.edu/catalog.php?record_id=9853

This popular trade book, originally released in hardcover in the Spring of 1999, has been newly expanded to show how the theories and insights from the original book can translate into actions and practice, now making a real connection between classroom activities and learning behavior. This paperback edition includes far-reaching suggestions for research that could increase the impact that classroom teaching has on actual learning.

Like the original hardcover edition, this book offers exciting new research about the mind and the brain that provides answers to a number of compelling questions. When do infants begin to learn? How do experts learn and how is this different from non-experts? What can teachers and schools do-with curricula, classroom settings, and teaching methods--to help children learn most effectively? New evidence from many branches of science has significantly added to our understanding of what it means to know, from the neural processes that occur during learning to the influence of culture on what people see and absorb.

Bransford et al (2005). ***How students learn: History, mathematics, and science in the classroom.*** Washington, DC: National Academies Press.http://www.nap.edu/catalog.php?record_id=10126

How Students Learn: History, Mathematics, and Science in the Classroom builds on the discoveries detailed in the bestselling *How People Learn*. Now, these findings are presented in a way that teachers can use immediately, to revitalize their work in the classroom for even greater effectiveness.

Darling-Hammond, L. (2010). ***The flat world and education: How America's commitment to equity will determine our future.*** New York: Teachers College Press.
http://store.tcpress.com/0807749621.shtml

Duschl, et al (2007). ***Taking science to school: Learning science in grades K-8***. Washington, DC: National Academies Press.
http://www.nap.edu/catalog.php?record_id=11625

What is science for a child? How do children learn about science and how to do science? Drawing on a vast array of work from neuroscience to classroom observation, Taking Science to School provides a comprehensive picture of what we know about teaching and learning science from kindergarten through eighth grade. By looking at a broad range of questions, this book provides a basic foundation for guiding science teaching and supporting students in their learning. Taking Science to School answers such questions as:

• When do children begin to learn about science? Are there critical stages in a child's development of such scientific concepts as mass or animate objects?

• What role does nonschool learning play in children's knowledge of science?

• How can science education capitalize on children's natural curiosity?

• What are the best tasks for books, lectures, and hands-on learning?

• How can teachers be taught to teach science?

Michaels, et al. (2007). ***Ready, set, science: Putting research to work in your K-8 Classrooms.*** Washington, DC: National Academies Press.
http://www.nap.edu/catalog.php?record_id=9853

What types of instructional experiences help K-8 students learn science with understanding? What do science educators teachers, teacher leaders, science specialists, professional development staff, curriculum designers, school administrators need to know to create and support such experiences?

National Middle School Association **This we believe.**
http://www.nmsa.org/AboutNMSA/ThisWeBelieve/tabid/1273/Default.aspx

This book describes the 16 vital characteristics of successful middle grades schools, and is a critical resource for everyone involved in the education, health, and well being of today's young adolescents. Now in its fourth edition, NMSA's landmark position statement shares the enduring lessons learned in more than 35 years of active middle school advocacy. When its concepts are embraced, students are prepared for success in school and career.

**Webquest**
www.webquest.org

A WebQuest is an inquiry-oriented lesson format in which most or all the information that learners work with comes from the web.