MATE ROV Competitions:
Providing Pathways to the Ocean STEM Workforce
Annual Report
July 1, 2011 through June 30, 2012

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, professional societies, and working professionals. MATE's mission is to provide the marine technical workforce with well-educated working professionals and to use marine technology as a tool to create interest in and improve STEM education.

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 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 make the transition from middle school through high school to college and into the workplace. It reaches out to 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 and adds a SCOUT class program to 12 existing regional competitions. It uses MATE's existing regional competition network as the mechanism to build and strengthen 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 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.

ACTIVITIES IN YEAR 3

The activities in Year 3 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 3:

- Provide 120 middle school teachers who serve underrepresented students with 28 hours of professional development.
- 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 1,200 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 professional development workshops and the MATE Summer Institute.
- Implement a beginner level ("SCOUT") competition class at 4 more of MATE's existing regional contests within the U.S.

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

Activities for Year 3:

- Based upon 1) information gathered during Year 1 and 2 on existing middle school career resources and 2) interviews with middle school teachers, start to modify existing resources, develop new career resources, and pilot test career videos.
- Provide hard copies of the *Guide to Marine Science and Technology Programs in Higher Education* to each new elementary, middle, and high school participating in the 2011 ROV competitions.
- Couple efforts with local postsecondary institutions to disseminate career information to the target middle school audience.

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 3:

- Continue to refine, expand, and promote the use of the ROVER (ROV Education and Resources) cyberlearning center.

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 3:

- Streamline the survey distribution, printing, and return process.

- Create Spanish translations of student and parent surveys.
- Analyze data from pre/post professional development workshop surveys, Summer Institute feedback and six-month follow-up surveys, and all 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, and web site.
- Provide formative advice to the project PI/Co-PIs.
- Analyze data and write Grant Year 3 evaluation report.

MAJOR ACCOMPLISHMENTS

Between July 1, 2011 and June 30, 2012 the MATE Center and its ITEST project partners:

- Offered 48 professional development workshops to more than 240 middle school teachers who serve underrepresented students. These workshops plus the experience on contest day provided between 5 and 32 hours of professional development. Follow-up student workshops and other activities (such as presentations by industry professionals as well as classroom mentoring by high school students, college students, and industry professionals) provided additional hours (between 8 and 32) to teachers in several regions.
- Offered one entry-level Summer Institute for Faculty Development that provided 12 Year 2 teachers with an additional 56 hours, for a total of 84 hours.
- In July of 2012, offered a second entry-level Summer Institute for Faculty Development for 20 teachers. All are Year 2 regional ITEST teachers; participating in the Institute will provide them with an additional 56 hours of professional development, for a total of 84 hours.
- Offered 388 student workshops, classroom visits, outreach activities, or other hands-on opportunities that reached more than 3,300 middle school students. These students received at least 3 and up to 40 hours of instruction and hands-on learning experiences. These activities also served as venues to deliver career information, which included "career profiles" presented by industry professionals.
    - Broader impact: In Hawaii-Oahu, in addition to 83 workshops and classroom mentoring visits, the regional participated in 17 community-wide outreach activities that included the annual "Biggest Little Airshow." This event is organized by the Pacific Aviation Museum and involved nearly 900 students and 700 parents.
- Engaged nearly 250 high school, 76 community college, 72 university undergraduate, and 6 graduate students as well as nearly 240 industry professionals to support these activities. More than 60 other organizations (businesses, research institutions, aquaria and other informal education facilities, high schools, and universities) supported this work.
- Engaged 350 parents in the project activities and, all total, surveyed 435 parents attending competition events about the changes they witnessed in their children as a result of the ROV program.
- Continued to work with the (now former) Shedd Aquarium education specialist to refine the draft middle school ROV curriculum. This curriculum has been disseminated to Year 1 and 2 ITEST teachers and reviewed by content experts. Received permission from the

Mechanical Engineering Department at Villanova University to use lessons from their underwater robotics curriculum (see www72.homepage.villanova.edu/aaron.wemhoff/URC/Underwater%20Robotics%20Curriculum.pdf). This information, along with photos and illustrations from MATE's underwater robotics textbook, are currently being incorporated. The goal is to finalize the curriculum and disseminate it to ITEST teachers, project partners, and via the ROVER web site during the one-year, no-cost extension of the grant.

- Implemented a beginner level ("SCOUT") competition class event within 4 more of MATE's existing regional areas within the U.S. To date, ITEST has supported the implementation of SCOUT class events within 12 of MATE's U.S.-based regionals.
- Based upon information gathered during Years 1 and 2 on existing middle school career resources and from interviews with middle school teachers, started to modify existing resources, develop new career resources, and pilot test career videos.
- Worked in partnership with the Marine Technology Society (MTS) to provide hard copies of the *Guide to Marine Science and Technology Programs in Higher Education* to the nearly 200 new elementary, middle, and high schools that participated in the 2012 ROV competitions.
- Continued to connect and work with local postsecondary institutions to combine career information efforts. Used the professional development and student workshops, classroom visits, and competition events as dissemination vehicles.
- Continued to refine, expand, and promote the use of the ROVER cyberlearning center throughout Year 3. ROVER again hosted 100% of the participant portion of the MATE ROV competition season. More than 2,500 students, mentors, and judges who took part in 2012 competitions utilized ROVER to register their involvement.
- Conducted data collection (surveys, structured interviews, observations, records review, etc.), cleaned and analyzed data, and produced a report, which included an analysis of the findings by demographic factors. Also translated student and parent surveys into Spanish.
- Held a regional coordinators' meeting that debriefed the 2011 competition season; presented plans for the 2012 competition; provided details about Year 2 of ITEST, including evaluation data and how regions implemented the grant activities; and shared lessons learned, discussed strategies, reviewed challenges, and gathered feedback to help shape Year 3 implementation.
- Provided updates to the Curriculum and Cultural Advisory Committee.
- Presented information about *MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce* and/or delivered hands-on ROV workshops at nearly 60 conferences, meetings, community events, and other outreach activities, reaching thousands of educators, students, working professionals, and community members.
    - Broader impact: The chair of the Ocean and Marine Engineering Division of the American Society for Engineering Education (ASEE) arranged a special technical session featuring the MATE Center, its underwater robotics competitions in particular, at the 2011 annual ASEE Conference.
- Published articles and information about MATE's ITEST project in nearly 50 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. Regionals implementing activities in Year 3 used the collective "lessons learned" as well as brainstorming discussions from the 2011 coordinators' meeting to carry out or make improvements in their methods, delivery, and level and type of support.

For example, a common challenge for all regionals in Year 1 was the level of instruction to provide the teachers, particularly in the area of electricity, simple circuits, and soldering. Solutions implemented with success in Years 2 and 3 were 1) mentors in the afterschool classroom and 2) additional, focused workshops for both teachers and students. Another challenge noted in Year 1 was the difficulty two regionals had in trying to "sell" the ROV project as a valuable and appropriate learning experience to schools. A letter addressed to principals and school administrators as well as a middle school ROV program "highlights" document, packed with survey results, quotes, and photos, helped regionals to address concerns and demonstrate the value of the program. The draft middle school curriculum also allowed each region to better demonstrate the connection between science in the classroom and the ROV project.

In the first year of the grant, the regional coordinators collected demographic data from the participating teams, schools, and clubs. This method of collecting demographic data was a burden for the regional coordinators, triggered confidentiality concerns among participants, and resulted in inconsistent data. In Years 2 and 3 of the grant, demographic data collection was simplified by relying on self-reports within the post-competition surveys for gender, ethnicity and disability status and matching participant zip codes to census data to create a proxy for socioeconomic status. In addition, the post-competition surveys were made "scannable," which helped to ease the burden of hand data entry as the number of participants increased.

The original implementation schedule had the Hawaii-Oahu, Hawaii-Big Island, Texas, and Mid-Atlantic regions carrying out ITEST activities in Year 2. However, due to personnel challenges on the Big Island and in Texas, those regions deferred until Year 3. The Florida and Great Lakes regions were asked to step up to Year 2 in their place. The Big Island and Texas, along with the Midwest and Southeast, were the final four regions to implement ITEST activities in Year 3.

Demographic data collected from 11 regions (Monterey, the Pacific Northwest, New England, Southern California, Florida, the Great Lakes, Oahu, the Midwest, Southeast, Texas, and Pennsylvania) show that 43% of the students were of minority background. Socioeconomic data revealed that 41% of the students came from high poverty areas. Two percent reported that they had disabilities requiring accommodations. (See the evaluation report included in the Addenda for more information as well as specifics about the data collection and analysis.)

Teacher, student, and parent surveys showed overall positive results. Ninety-nine (99%) of the teachers responding to post-professional development workshop surveys rated the usefulness of the workshops as either good or excellent; the majority (82%) also felt that the training had addressed their concerns about mentoring students in designing and building ROVs. Eighty-three percent (83%) of the teachers felt more committed to participating in the competition.

In post-competition student surveys, 80% of the respondents reported an increased knowledge of marine-related STEM careers as a result of the ROV project. More than half (56%) of the students stated that their ROV project made them more interested in a marine career. Among the teachers/mentors who completed post-competition surveys, 96% of the respondents reported that they observed improvements in their students' STEM knowledge and skills. Ninety-two percent

(92%) of the teachers/mentors mentioned that they observed increases in their students' skills in team building, problem solving, and/or critical thinking.

The results of parent surveys were also encouraging. Ninety-one percent (91%) stated that building an ROV has made their child more interested in STEM; 81% responded that participation in the program had made it easier to picture their child in a STEM career. Sixty-eight percent (68%) of parents reported that their children were better able to work with others due to their involvement in the ROV project; 91% said that their child's self-confidence had improved. Ninety-nine percent (99%) of the parents rated their children's experience building and competing with an ROV good or excellent.

Judges and volunteers were also surveyed again this year, in 10 regions. Of those responding, 97% agreed that the competition helps motivate students to learn science, technology, engineering and math, while 94% agreed that it helps strengthen students' 21st Century Skills, such as teamwork and critical thinking. Ninety-five percent (95%) felt that the competition helps prepare students for careers in marine science, technology, and engineering.

As in previous years, there were things that worked well and things that did not work well in each region. For example, in Monterey, student and parent surveys translated into Spanish supported the reach into a primarily Spanish-speaking school district. It especially helped parents to feel engaged. On the Big Island, recruiting teachers through the "standard" chain of command (school district administrators > principals > teachers) yielded zero interested participants. Rather, reaching teachers through other STEM-related events (e.g. First Lego League contests) resulted in individuals motivated to take part. In terms of broader impact, four U.S.-based and one foreign regional used ITEST to leverage additional sources of outside funding to support their work and to engage high school teachers and students, building both capacity and the STEM educational pathway.

Feedback from Year 1 and 2 teachers, MATE staff, content experts, and colleagues at Immersion Presents were incorporated into the draft curriculum. In addition, we received permission from our Pennsylvania regional colleagues in the Mechanical Engineering Department at Villanova University to use lessons from their underwater robotics curriculum. This information, along with photos and illustrations from MATE's underwater robotics textbook, are currently being added to the document.

As noted above, several steps were taken to help demonstrate the value of the program to school administrators and to address the challenge of recruiting middle school teachers from each region for the ITEST Summer Institute. We circulated general information about the Institute early in the school year and encouraged Year 1 and 2 Summer Institute "alumni" to promote the experience to their colleagues and recommend teachers to apply.

ROVER continued to serve as a portal for information, resources, communication forums, links to outside sources, social media outlets, and more. It also served as the one-stop shop for competition information, communication, and participant support again this year. From mid-June 2011 until present, the site has received 43,242 unique visitors. The majority of visitors (69% of those completing a first-time user survey) were students. The main resource visitors were seeking was ROV competition information (93%), followed by technical resources for building ROVs (36%).

The process for distributing surveys to the regional coordinators was streamlined using FedEx Kinko's. As noted above, student and parent surveys were translated into Spanish, which was extremely helpful in collecting information within eight regionals. Other evaluation successes as well as challenges are discussed under Objective 4 below and included within the evaluation report (see the Addenda).

DETAILED DESCRIPTIONS OF ACTIVITIES AND FINDINGS ORGANIZED BY OBJECTIVE

Detailed information on Year 3 activities is organized by objective and presented below.

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 four U.S-based and two foreign regionals have been established, bringing the total number of MATE regional ROV competitions (U.S-based and foreign) to 22. 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. It was, at the time, the only regional with an established support infrastructure (professional development workshops, topic-specific workshops for students, well over 20 parents involved as mentors, instructional materials, and a pool of "seasoned" volunteers) for SCOUT class teams.

The implementation plan for this objective uses Monterey's support infrastructure as the model for regional coordinators to modify, improve, and expand so that it plays upon their local collective strengths, uses local resources, and best suits the needs of their local middle school target audience.

The implementation schedule started with the four regions best positioned to successfully carry out this work; based on the results of MATE's workforce studies, these regions were also the experiencing the most significant workforce challenges. Four more regions were added in Year 2; four more were added in Year 3. The original implementation schedule was 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

However, due to personnel challenges on the Big Island and in Texas, those regions deferred until Year 3. The Florida and Great Lakes regions were asked to step up to Year 2 in their place. In Year 3, all 12 regions carried out ITEST activities.

While there were similarities, each region had a distinctive approach to implementing and carrying out the grant activities. We see this as a strongpoint in that each region developed its own unique model of implementation – with its own strengths, challenges, lessons learned, and improvements – that can then be shared across the MATE regional competition network and with the larger STEM education community. 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.

"RETURNING" ITEST REGIONS: MONTEREY, SO-CAL, PNW, NEW ENGLAND, MID-ATLANTIC, OAHU, FLORIDA, AND GREAT LAKES

MONTEREY

The Monterey Bay Regional ROV Contest is organized by the MATE Center and Monterey Peninsula College (MPC). MPC's Technology Preparation ("Tech Prep") Program, the Monterey Bay Aquarium Research Institute (MBARI), the MTS-Monterey section, the Monterey Bay National Marine Sanctuary, and the Seymour Center at University of California Santa Cruz's Long Marine Lab, among other organizations, support the event.

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, 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 competition program's technical manager and head rules judge. Matt also coordinates the technical aspects and poolside operations at the Monterey regional. Jeremy Hertzberg, another consultant for the MATE Center, provides additional technical support. The MPC fiscal office is the fiscal agent for the ITEST funds.

Again this year, the Monterey region opted to sacrifice quantity for quality and provide a second year of professional development, equipment, and mentor support to the Pajaro Valley Unified School District (PVUSD) afterschool programs that began their involvement in Year 2. Otherwise, the concern was that the program would not be sustained in these schools. Because its lead ROV teacher moved to a new school, La Mesa Elementary School from the Monterey Peninsula Unified School District (MPUSD) requested and was granted a third year of support.

In addition to La Mesa Elementary and the four returning schools from PVUSD (Ohlone, H.A. Hyde, and Radcliff Elementary Schools and the Watsonville Environmental Science Workshop), the following new schools took part in Monterey ITEST in Year 3: E.A. Hall Middle School (PVUSD); Calabasas Elementary School (PVUSD); Ann Soldo Elementary School (PVUSD); Shoreline Middle School (Santa Cruz Unified School District); New Brighton Middle School (SCUSD) and the Greenfield Community Science Workshop (like the Watsonville Environmental Science Workshop, this is a community resource that provides afterschool as well as Saturday programs for one local elementary school, the middle school, and the high school in the Greenfield Unified School District).

MATE continued its "community partnership" with the Service Learning Institute at CSUMB. Nine students enrolled in the computer science, technology, and environmental justice service learning courses requested to serve their 30+ hours as in-classroom mentors for the participating schools. Jill also reached out to area high school and community college students; two students from the Aptos High School Robotics team, one from the Monterey High School ROV team, and one from the MPC Robotics Club stepped forward. Dan Atwell, a long-time supporter of the MATE ROV competition program, also volunteered to mentor a local school.

In preparation for working within the schools, the MATE Center held an orientation for the student mentors, which included presentations describing the "teen brain," appropriate behavior when interacting with minors/younger students, and what to expect in the middle school classroom. During the orientation, the mentors were asked to commit to visiting the schools for at least 2 hours one to two days per week for eight weeks. Not including Dan (who spent significantly more hours than any other mentor), the 13 mentors spent an average of nearly 33 hours in the classroom.

Based on feedback from teachers in Year 2, two professional development workshops were offered – one full day followed by one-half day. The second, half-day session was scheduled three weeks after the first to give teachers time to start the project and return with questions and get additional, specific training. This half-day was open to all Monterey ITEST teachers, so it also

provided an opportunity to network, seek advice, share lessons learned, etc. The workshop flyer and application are included within the Addenda.

Eleven teachers/afterschool coordinators representing nine of the Year 3 schools participated in the first, full day of professional development. Mentors were matched with teachers/schools based on proximity to home and school; in some cases, two mentors were assigned to one school. During the workshop, the mentors worked side-by-side with their teacher so that they could begin to get to know one another and establish a rapport. High school students from the Watsonville Environmental Science Workshop and the Greenfield Community Service Workshop also attended; they served as mentors to the students participating at these locations.

Eleven teachers/afterschool coordinators participated in the second, half day. Two of these teachers were from Year 1 MPUSD schools, which made them excellent resources for those just starting the project.

In addition to mentors, all of the schools were provided with the opportunity to take part in an "open house" wiring workshop as well as two pool practice sessions at MPC where they could receive additional technical assistance from Matt, Jeremy, and industry volunteers.

The Monterey region held its SCOUT class competition event in conjunction with the existing Monterey Bay Regional ROV Contest on Saturday, May 12, 2012. All total, a record 58 SCOUT teams participated. Of those 58, 17 were teams from ITEST schools. Each of the six, new Year 3 ITEST schools fielded a team; all but one of the PVUSD schools returning from Year 2 had one or more teams take part. La Mesa Elementary entered a team, as did two (of the three) other MPUSD schools that started in Year 1. All total, including the ITEST teams at the contest and the students who attended wiring workshops, camera workshops, and pool practice days, the ITEST grant supported the participation of 350+ students in the Monterey area.

What Worked

Again this year, the partnership with CSUMB's Service Learning Institute and a very active high school student robotics club helped tremendously in making sure that the schools received adequate technical support and had access to pools and other resources. Having skilled mentors meet regularly in the classroom provided the teachers with the help that they needed, especially with the assembly of the control boxes. The increased mentor pool also allowed Jill to focus her time and energies on managing the Monterey region activities and serving as the grant PI.

While the majority of the mentors were white males, four were female (one female was also Hispanic/Latino) and one was Syrian. We recognize the importance of providing role models that "look like they do;'" however, the students were still able to make connections, particularly the young girls who had female mentors. Comments included in an e-mail sent by the Ohlone Elementary teacher demonstrate this:

It was an amazing experience for my students to work with them. They were helpful, patient and respectful, to say the least. We couldn't have done it without them, and the kids will never forget them, especially the girls!

Similarly, the mentors benefitted as evidenced by this e-mail from one of the CSUMB students:

I just wanted to thank you for giving me the opportunity to have the MATE Center be a part of my service learning experience! I had a wonderful experience and it's something I will not forget! I can tell that this program makes a difference with the students because they are actually excited to be applying what they are learning in the classrooms. I hope to continue to keep in contact with you and offer my services when I am available!

The second, half-day follow-on workshop for teachers was very well received and appreciated. Based on personal communication with the attendees, it helped to ease their concerns, provided

additional (in a few cases individualized) technical training, and allowed them to build a sense of community.

Based on feedback from Year 2, we modified the schedule/"course outline" for implementing the ROV project by including more detailed information (e.g. "cover waterproofing techniques and waterproof motors") and milestones (e.g. "control box/motor assembly should completed and operational"). Teachers appreciated this level of detail and, in particular, the specific deadlines to work towards. This improved course outline is included within the Addenda.

Also based on lessons learned in Year 2, the date of the Monterey regional was carefully vetted so as not to conflict with activities of other local organizations and moved to mid-May to allow the schools more time to complete their vehicles and prepare their engineering presentations and poster displays. This proved successful as 17 teams representing 12 ITEST schools participated in the competition. What also proved successful was adding a second, half-day workshop several weeks after the first. This gave teachers the time to start the program in their classrooms, bring mentors in, then return with questions and additional, focused training.

What Didn't Work and Lessons Learned

Given Monterey's already packed SCOUT class competition, accommodating additional teams is always challenging. Encouraging the schools to hold their own internal "run-offs," with the top winning team(s) moving on to participate in the regional contest, is helpful, but often discouraging to teachers and students. New and "veteran" teams – often teams with older, more experienced students – participating in the same competition class can also be discouraging. To help combat this, in 2013 the Monterey region will divide the SCOUT class into "new" and "returning" teams. Teams where the majority of students are participating for the third (or more) time will be place in the "returning" class. We will also offer to host in-school run-offs during pool practice days, on "competition-grade props," and with MATE staff and volunteer industry professionals serving as judges, which will help to make it more of a "special" competition experience.

SOUTHERN CALIFORNIA

The Southern California Regional ROV Fly-Off is organized by Long Beach City College (LBCC) and supported by the MTS-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. Reggie Monday is LBCC's Career and Technical Education Project Manager; Michelle Whitfield is the Workforce Development Program Director in the college's Office of Economic and Resource Development. They work closely with Scott to make connections to local schools and support the grant activities. Marty Alvarado, from the LBCC grant's office, oversees the financial aspects of the grant and contributes to the annual reporting of ITEST activities.

The time and energy that went into approving the partnership between LBCC and the Long Beach Unified School District (LBUSD) in Year 1 was well spent. Again this year, LBUSD arranged an orientation for new teachers where Scott presented information describing the program and activities. His presentation included examples of LBCC students who had been involved in STEM programs and where they are now – from pursuing engineering degrees to entering careers in the ocean technical workforce. These "student success stories" helped to solidify the value of the experience and encourage teachers to get their own students involved.

Like Monterey, Southern California made the decision to continue to work with four of the schools (Henry K-8, Lindbergh Middle School, Marshall Middle School, and Robinson Academy) that had participated previously. Each of these schools requested the support as well as the opportunity to send new teachers to the professional development workshops. Scott and his colleagues felt that another year of support would help to ensure that the program was sustained.

Following the orientation presentation, Scott visited 11 LBUSD schools. These visits included setting up a demonstration tank and allowing the teachers and students to assemble then fly the ROV kits provided by the MATE Center. In addition to the hands-on activity, Scott discussed ROVs, robotics, and careers in ocean STEM.

Two, day-long professional development workshops were provided for teachers from 10 LBUSD schools, including four middle schools (Burcham K-8 School, Butler Middle School, Hughes Middle School, Powell Academy) and five high schools new to the ROV program this year. In addition, two teachers from one LBUSD high school were included in the training since the previous ROV instructor at that school had retired.

The workshops were held at LBCC and, like Monterey, were offered two weeks apart to give teachers the time to start the program and return with questions and for help where it was needed. 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.

Again this year, Scott recruited LBCC students from his EXPLORER class ROV team to serve as mentors at each of the four new middle schools participating in Year 3. These students worked side-by-side with the teachers during the workshops.

After the workshops, teachers had the opportunity to take the ROV kits back to their classrooms and use them to kick-off the project with their students. In addition, the teachers and their student teams were given the chance to participate in an all-day pool practice session held at LBCC. The LBCC student mentors were on hand during this session to provide technical, troubleshooting, and piloting support. The schools also used the practice day to hold "run-offs" to select the top two teams of students who would move on to the competition.

The culminating event was the SCOUT class competition, which was held as part of the Southern California Regional Fly-Off on May 12th. All total, 23 SCOUT class teams participated, all from ITEST schools. In addition to students from LBCC, two students from California State University Long Beach as well as industry professionals volunteered as judges and technical support.

After the competition, LBCC faculty and LBUSD teachers who participated in the ROV activities shared their feedback at a "wrap-up" meeting held on June 5th. Many of the comments focused on student successes. The teachers expressed how their students gained confidence in themselves, learned to think on their feet, and developed time management skills while working on their ROVs and summarizing the technical information for their poster displays.

What Worked

As in years past, the involvement of the LBCC students as team mentors was especially valuable. The middle school teachers appreciated the help and actually requested additional student mentors in order to reduce the student to mentor/teacher ratio. Not only did it help the college students to solidify their own learning, it was also a valuable resume-builder.

From the wrap-up meeting, it was evident that the teachers gained confidence in delivering and facilitating STEM learning experiences. It was also evident that they felt their students gained confidence, too. One school, participating for the second year, expressed how its students who were involved last year stepped up and became the team leaders. Teachers also commented how they observed students who held power drills in their hands for the first time became "different students," developing confidence as well as critical thinking skills. One middle school engaged its special education students, who then in turn engaged their parents in supporting the project. Several other schools also had a "team-parent" who supported the teachers by filling in gaps in logistics and learning.

The fact that the college's grant office is actively involved played a key role in ITEST success. For example, in addition to helping Scott with grant management, the office leveraged Perkins/Career and Technical Education Transition Funding to cover stipends for the teachers participating in professional development activities.

What Didn't Work and Lessons Learned

Scott and his partners recognize the need for additional volunteers and are working to formalize the volunteer process for the regional competition. This process will include a "volunteers" web site that describes each volunteer position and provides training (how-tos, examples, advice from previous volunteers, etc). The site will include a sign-up sheet to allow volunteers to register and commit to specific positions. The hope is that this resource will help potential volunteers to better understand their role and commitment and lessen the number of "no-shows" on the day of the event.

Teacher stipends are a double-edged sword. The stipends help to bring teachers in, but then the teachers become dependent on them. In these economic times, with budget cuts at the college and elsewhere, there is no guarantee that funding for stipends will be available in the long-term. The Southern California region is putting energy in developing a self-sustaining industry support mechanism to fund stipends as well as building materials, so that the program can continue after ITEST. The region is also working on formalizing the ROV program as part of LBUSD's approved curriculum and career pathways.

PACIFIC NORTHWEST

The Pacific Northwest (PNW) Regional ROV events and ITEST grant activities are organized and run by the Puget Sound Section of the Marine Technology Society (PS-MTS). Fritz Stahr, Rick Rupan, and Wes Thompson are the co-lead coordinators of the regional as well as the co-leads on the ITEST grant activities. Fritz is the current PS-MTS Chair, Rick is the Outreach Coordinator, and Wes is an MTS member. All three are professional engineers and scientists at the University of Washington (UW). The PS-MTS is the fiscal agent for the grant funds, operated by Treasurer Karl Kunkle.

During this third and final year of ITEST grant implementation, Fritz, Rick, and Wes decided to expand their reach beyond the Puget Sound metro area and move to a rural one – Newport, Oregon. This allowed two things: 1) serving a population that typically does not have access to hands-on high-technology education and 2) fulfilling their proposed goal of reaching underserved rural districts. To that end, they conducted a teacher workshop in January for ten teachers from the Lincoln County, OR area. They were fortunate to recruit an employee of the Lincoln County School District (Ruth MacDonald) who has district-wide STEM education as part of her responsibility. Ruth's help recruiting teachers for the workshop and the competition event was invaluable. In addition, Fritz, Rick, and Wes were able to recruit help from the Oregon Sea Grant office through Tracy Crews, Sea Grant's Marine Education Coordinator. Tracy attended the workshops and the annual PNW Regional ROV Challenge in May to see first-hand how the event is run.

Based on last year's success, the workshop agenda guided teachers through the slower, more challenges topics (learning to solder and complete the wire assemblies) early in the day. As a result, the teachers took home fairly complete ROVs, which gave them high confidence in being able to guide their students through a similar activity. During the workshop, teachers received hard copies of slide presentations regarding ROV basic physics and basic circuitry as developed by Rick and Wes. In addition, teachers were provided with a copy of the latest revision of curriculum being developed under the ITEST grant. The teachers very much appreciated the hard copies and felt comfortable having teaching modules in hand.

Follow-up visits to Oregon schools were conducted by Tracy and members of the Linn-Benton Community College EXPLORER Class team. This activity was difficult for the Fritz, Rick and Wes to participate in due to the ~6 hour drive from Seattle to Lincoln County, so they relied on

Tracy and the community college students to provide this support. Like last year, parents were the key to keeping the efforts going; many of them attended the competition event in June where they completed the feedback surveys.

In addition to the ROVs from the workshop, ITEST funds were used to provide each teacher with two additional kits of ROV building parts. This decision was based on experience from last year in which most of the region's "mini-grant" funds went to materials for the student ROVs. These kits became the basis for almost all of the SCOUT ROVs that participated in the culminating event for Oregon teams, which was held in June (see below).

Again this year, the large test tank at UW's School of Oceanography was made available for teams to practice and fine-tune their ROVs. The three, half-day practice sessions that took place in April were supervised by one of the three co-coordinators and attended by a number of teams, though none from the Oregon region. During these sessions, Fritz, Rick, and Wes had substantive interactions with parents, including one parent who is the regional coordinator for the First Robotics competition. He commented that the MATE ROV competition was more rewarding for his children as they are able to be much more inventive with their designs.

Twenty-two teams participated in the PNW Regional ROV Challenge SCOUT class at the Weyerhaeuser King County Aquatic Center in Federal Way, WA on May 12th. Some of those teams were lead by teachers that had participated in ITEST program activities in Years 1 and 2. One of those teams, a group of home school students, is a regional ITEST success story. AMCO & CO started with the program in Year 1. In 2012, the team stepped up to the RANGER class, where they finished second overall. As a result taking second place, the team won the right to advance to the international ROV competition in Orlando, FL.

The culminating SCOUT event for Oregon teams was held separately from the PNW Regional Challenge and took place on June 2nd at the Oregon Coast Aquarium in Newport, OR. Sixteen teams were registered for the SCOUT class event in Oregon a week before the event. However, due to a conflicting sports event for several of the teams, only nine competed. The Oregon Coast Aquarium was a very gracious host and provided one of its large animal-husbandry tanks for the underwater missions at no cost. The only down side was that it was difficult for spectators to see into the tank. Fritz, Rick, and Wes attempted to help this situation by providing the support SCUBA divers with underwater camera whose video was fed to a 50-inch flat-panel screen topside where the spectators could watch from folding chairs. With the help of the new Oregon MTS Section and Tracy Crews, more than 20 marine technology professionals were recruited to serve as judges, including a number of individuals from the various state and federal offices on the Hatfield Marine Science campus (NOAA, EPA, ODFW, etc.). These volunteers were quite impressed with the organization and level of sophistication of the ROVs for beginning middle school students; the interaction between them and the students was tremendously rewarding to watch. It is expected that many of these professionals will volunteer again next year when the new, Oregon MATE regional competition for both SCOUT and RANGER competition classes is implemented.

What Worked

Parental involvement continued to play a key role in the program's success. Parents were again encouraged and welcomed at workshops and at the events themselves. The unanticipated large turnout of parents and other spectators at the Oregon SCOUT event demonstrates that parents in this region have and will hopefully continue to take an interest in and support their children's participation.

As in the past, the partnerships were also key to the success of this effort, particularly between Lincoln County School District, Oregon Sea Grant, Hatfield Marine Science Center, the Oregon Coast Aquarium, Linn-Benton Community College, Oregon State University, and PS-MTS. Expanding the program to a remote and rural district posed some problems but the co-coordinators were able to overcome those challenges through these partnerships. Moreover, it

allowed the regional ITEST leads to serve their targeted underrepresented population. The sentiment is that ROV programs in Oregon will keep growing and engage many more students in both urban and rural districts. The hope is that this growth can take place without ITEST grant support, but that depends on the value that partners and participants see in it for preparing future marine technologists. The regional leads will work to make that case.

What Didn't Work and Lessons Learned
The competition event facility at the Oregon Coast Aquarium left a few things to be desired (leaky roof, glare on the screen for the underwater camera, limited pool-deck space), but now that the Aquarium has experienced hosting the event, it may be able to make some simple modifications to improve the venue. The other issue was a large number of teams backing out at the last minute due to over-scheduling of the students (e.g. baseball tournament on same weekend). However, this is something that will likely always be a challenge with middle school students. Some form of "community" scheduling, or making the parents more aware of the participatory nature of this event, should help. Overall, however, the program was successful in engaging rural students in a new avenue of STEM education and activities. And, as in previous years, it was also successful in supporting a beginner, entryway into the competition pathway in the PNW.

NEW ENGLAND
The New England Regional ROV Contest is organized by the MTS-New England section. The contest is supported by both individual and company members of the MTS-New England section, the Massachusetts Maritime Academy (MMA), 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 Sustainable and Green Energy (SAGE) Program, which is funded through NSF-Advanced Technological Education. Anthony Ucci, a BCC faculty member and SAGE Project PI, assists 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, provides technical assistance during the professional development workshops and SCOUT class competition event. Sue Mauretti-Black, an engineering and technology teacher at Durfee High School and MATE Summer Institute alumnus, serves as a "teacher trainer" and local resource. In addition to the MTS-New England section, Lockheed Martin Sippican and Benthic Exploration provide personnel and technical resources to support teacher professional development. Again this year the Boys and Girls Club of Fall River and New Bedford High School provided access to facilities.

Teacher recruitment in year 3 built on activities completed in Years 1 and 2. As in years past, Meghan, BCC engineering students, and several of her partners participated in the New Bedford Working Waterfront Festival and several STEM CONNECT Partnership events. The CONNECT Partnership is a collaborative made up of the five state community colleges and universities located in Southeastern Massachusetts. In addition to the traditional marketing strategies (participating in community events, e-mails to teachers and administrators, classroom presentations, and engaging past teachers to recruit new teachers to become involved), this year Meghan also began to market the teacher workshops and ROV activities through the CONNECT Partnership newsletter, which is distributed monthly to teachers and administrators throughout southeastern Massachusetts.

Two ROV professional development workshops were offered in Year 3. Both workshops were eight hours long and provided a basic overview of how to design and build an ROV. In addition to the workshops, teachers that did implement an ROV program at their school as part of their curriculum or as an afterschool program received ongoing support from Meghan and Sue Mauretti-Black as well as BCC student mentors.

The first workshop was offered on Saturday, October 22, 2011 to three middle school teachers, five high school teachers, and two BCC engineering student mentors. The second workshop was held on Saturday, February 4, 2012 and had a stronger turnout, with 10 middle school teachers (one repeating from the fall), six high school teachers (two repeating from the fall to learn how to waterproof motors), and five BCC engineering student mentors. During the October workshop, Keith Bradley, a middle school teacher from Henry Lord Middle School who participated in the ROV program the previous year and attended the 2011 ITEST Summer Institute, spoke to the teachers about Institute and how he integrated ROVs into his marine science curriculum. During the February workshop, a portion of the agenda was dedicated to waterproofing motors and an overview of the 2012 MATE ROV competition.

As a result of these workshops, new ROV programs started at two middle school afterschool programs and one high school integrated program between CAD and Electrical Technology; two programs were reinstated, one at a middle school and the second at a local high school through the ROTC program; and three new schools, one middle school and two high school programs, plan to come on board with ROV programs during the 2012-2013 competition season. Finally, four teachers who participated in the winter workshop applied for and were accepted into the 2012 ITEST Summer Institute in Monterey.

Student recruitment in Year 3 also built on lessons learned in Years 1 and 2. As in Year 2, the majority of student recruitment was done by teachers who participated in the ROV workshops that then went back to their schools and encouraged students to participate in their afterschool programs. In Year 3, more than 230 middle school students participated in ROV activities that ranged from 10-week after-school programs to ROVs integrated into a marine science course.

Three middle school ROV programs that started in previous years of the grant continued to grow and expand. Keith Bradley expanded this activity to all of his marine science courses. As a result, each trimester of the school year approximately 80 middle school students will complete between 20 to 24 hours of classroom time designing, building, testing, and competing in a mini-ROV competition. The first group of 80 students built ROVs during the fall trimester; 28 teams competed in a mini-ROV competition on October 26, 2011. During the second trimester, 26 teams consisting of 82 new students built and competed in a mini-ROV competition on January 12, 2012. Unfortunately, due to a teacher illness, Keith was reassigned to cover the physical science program during the third trimester of the year and was unable to run the third trimester ROV program as initially planned. His plan is to provide the experience to all three trimesters during the 2012-2013 school year.

The 3rd annual SCOUT class competition was held in conjunction with the New England Regional MATE ROV Competition on April 28, 2012 at MMA. Eight teams representing 26 students from four schools participated. Originally, 12 teams were registered to compete; however, one school, Global Learning Charter, with four teams dropped out two weeks before the event due to technical problems. So as to not lose this school going forward, Meghan and her partners set-up a mini-competition for these teams at New Bedford High School on May 14, 2012. BCC engineering students (including one student who acted as the middle school mentor) and the New Bedford High School ROV teacher helped to set up and carry out the competition. Students from the afterschool program were very excited to compete and are now preparing for next year's regional event. In addition, two teachers from this school were accepted into the 2012 ITEST Summer Institute and plan to integrate the ROV activities into their programs in the coming year.

All total, 19 college students from three institutions, including the five BCC students mentioned above, volunteered this year. These students provided technical support at teacher professional development workshops, mentored afterschool ROV teams, built RANGER and SCOUT competition props, and served as judges and support staff for the 2012 SCOUT class ROV competition.

A broader impact of the New England region's work is its involvement in a summer educational/enrichment program for at-risk youth in the Fall River area. The program ran July 2 – August 10, serving nearly 40 middle school students who are at risk of not moving on to high school. Helder Lobo, a former BCC ROV team member who is now currently completing his bachelor's degree at MMA, was the program's lead instructor and guided the students through an ROV design and building project.

What Worked

The New England ITEST project relies heavily on the volunteer support of college students from BCC, UMass-Dartmouth, and MMA. The involvement of students from UMass-Dartmouth and MMA was not originally planned, but as former BCC students moved on to these colleges to complete their degrees they wanted to continue to participate.

The college students are instrumental in providing technical support. Students volunteer to participate in all student outreach activities as well as support the teacher professional development workshops. In Year 3, five new BCC students stepped up to become active ROV mentors. All five students participated in teacher professional development workshops and were then paired with a middle school ROV team to provide technical support to the teachers and students. This summer, two of these students volunteered to run a "train the trainer workshop" with new/incoming engineering club members who want to become involved in the ROV program. Currently, five new students, including three females, have shown interest in becoming ROV mentors.

Meghan and her partners continued to use community-wide events and festivals to engage parents and students who, in turn, engaged their teachers as an indirect way to make inroads into the schools. Having a teacher to act as an advocate and cheerleader for the program was also extremely helpful and a key to convincing schools to become involved. The materials "loaner" program implemented last year continued as a unique way to extend the grant resources; by far this has been the greatest lesson learned.

What Didn't Work and Lessons Learned

Based on Year 2's experience and lessons learned, Meghan made sure to have direct and regular communications with partner organizations. This included checking in with teachers and their ROV teams to keep on top of any issues or roadblocks. It also included checking in with the college student mentors to monitor progress and to make that they felt prepared to work with students in the classroom.

Another lesson learned from Year 2 that is being implemented this summer is a training session for the college mentors. Not only will this cover technical background and skills, it will also include how to work and interactive with younger students, manage classes, and behave appropriately in a middle school environment.

Finally, a lesson experienced in Year 1 and confirmed in Year 2: hold professional development workshops in the New Year/spring. These are typically much better attended, as teachers are more motivated to start to preparation for April regional competition closer to its date.

MID-ATLANTIC

The Mid-Atlantic Regional ROV Building Competition is organized and coordinated by Nauticus, the National Maritime Center. The competition is hosted annually by Old Dominion University and supported by local organizations such as the Chesapeake Bay Dive Center. Nauticus is also the lead institution on the region's ITEST grant. Peter Leighton, an education specialist at Nauticus, is the lead coordinator of ITEST activities. The Nauticus Foundation is the fiscal agent for the ITEST grant funds.

Prior to receiving ITEST funding, Peter had been offering afterschool ROV programs in the Hampton Roads, Virginia region. This continued to provide him with a teacher and student base from which to recruit.

In addition, Peter continued to use the ROV lab that he created at Nauticus last year to provide visitors with a simplified building experience. The lab has a large water tank and individual work stations outfitted with PVC pipe and motor/controller units. This lab proved to be particularly appealing to families and allowed teachers visiting with their families to get an idea of what the program could offer them during the school year.

Again this year, Peter presented to approximately 30 middle and high school teachers at the annual Cooperating Hampton Roads Organization for Minorities in Engineering (CHROME) Club sponsor lunch in October. CHROME is an STEM initiative designed to introduce minority students to math, science, and technology in afterschool clubs. As a result, the CHROME Club at Lake Taylor Middle School stepped forward to participate in the project. The CHROME Club at Landstown Middle School also stepped forward to take part again this year.

Starting in November, Peter began in-classroom visits with students and teachers at both Landstown Middle School and Lake Taylor Middle School. On a bi-weekly basis, he attended their afterschool programs to deliver supplies and assist the students with their ROVs.

At Landstown Middle School, Peter worked with a group of 15 students and their teacher through April of 2012, when they held their final CHROME Club meeting of the year. Unfortunately, again this year the teams were not able to participate in the actual regional SCOUT class competition. Knowing this, Peter brought a portable water tank for them to test their vehicles. He also set up a mini-competition where he simulated several of the SCOUT class mission tasks.

The SCOUT class competition was held along with the RANGER class at the Mid-Atlantic Regional ROV Building Competition on April 28th, 2012. After competing at the SCOUT level in 2011, both Granby High School and Boy Scout Troop 2540 entered the RANGER class. Seeing the more advanced vehicles and interacting with the more experienced students last year proved to be great experiences, as well as great motivators for these students to build upon their knowledge and skills in order to advance to the next level.

As a result of working with the Landstown Middle School CHROME Club last year, the students who graduated and moved on to Landstown High School formed an ROV team. Although they did not compete in 2012, one of the students volunteered at the competition. The team is considering entering the RANGER class in 2013.

A number of positive outcomes resulted from Peter's interaction with Granby High School. First, the Granby teachers actually learned from the training and were dedicated to the project. They were able to take things over and work with their students without Peter's help. As a result, the students moved on to the RANGER class in 2012. Also, the lead teacher for the engineering class, Rick Dyer, also leads a group of young Scuba divers. With Rick's encouragement, these students volunteered for the competition in both 2011 and 2012. Rick is moving to teach at a magnet school in Norfolk, VA and is planning to get his new students involved in ROV design and building. This is another possible new team in 2013.

What Worked

Again this year, coordinating the program through Nauticus was tremendously helpful. Not only does it provide Peter with access to local schools and volunteers, it allows Peter to promote the ROV program through Nauticus' existing professional development workshops as well as its school and public educational programs. Another advantage provided by Nauticus is the expansion of its "public" ROV lab and building program. Peter has found the public program to be one of the more effective tools for sparking interest and recruiting new teams. At least three schools and Boy Scout troops have expressed interest in participating next year as a result of

their experience in the ROV lab. Further, Peter trains and uses high school students as volunteers to run the public program on the weekends. These students then go back to their schools with the interest and knowledge and encourage their teachers and fellow students to participate.

The recruiting events and professional development workshops, both formal and informal, worked well in generating teacher and student interest in the ROV project. The informal events were actually more successful than the formal professional development workshops. One possible reason for this is that teachers are often required to participate in professional development. This means that they are not always enthusiastic about "outside the box" and/or extracurricular programs like the ROV competition. Teachers and parents who attend informal events are there because they choose to be. As a result, not only do they tend to be more interested, they tend to be more receptive to unique programs.

What Didn't Work and Lessons Learned

Motivating teachers to follow through with the project continues to be a challenge. Many more teachers expressed interest than actually participated. Also, although progress was made with Granby High School, many of the teachers lack the confidence to lead their students through designing and building the ROVs when Peter was not present to mentor and guide them.

Peter is working to increase his pool of skilled volunteers so that the program and classroom support does not rely solely on him. Specifically, he is reaching out to Old Dominion University and other local colleges to find and recruit this assistance. Another strategy is to build upon his high school volunteer base and ask those students to serve as mentors for the schools. Having additional volunteers to support the program will also allow Peter to expand his reach into other area schools/school districts.

HAWAII-OAHU

Broader impact: It is worth noting that the state of Hawaii is very "pro" robotics competitions; the previous governor used federal stimulus funding to back a mandate that Hawaii students have access to and are able to participate in robotics competitions, including MATE's. The Robotics Organizing Committee (ROC; see www.hawaiiroc.org) was created to facilitate this support. ROC also serves as an organizational "hub" for Hawaii robotics programs, building a robotics community for programs and their participants. The Friends of Hawaii Robotics is an offshoot of ROC; this organization manages and distributes the funds. This level of support and funding is enabling both Oahu and the Big Island to make significant headway in generating interest in the competition and building a pathway of students who progress from middle to high school (and SCOUT to RANGER) then on to postsecondary STEM programs on the islands or elsewhere.

The Hawaii Underwater Robot Challenge (HURC) is organized by the University of Hawaii at Manoa and supported by the university, the Hawaii sections of MTS and IEEE OES, and other local organizations. The University of Hawaii at Manoa is also the lead institution on the ITEST grant. The lead coordinator of ITEST activities is Timmie Sinclair, a former middle school teacher and 2010 ITEST Summer Institute alumnus. The university and the MATE Center are the fiscal agents for the grant funds.

Despite a slow start and difficulty "breaking in" to the Oahu region, the program grew by leaps and bounds in Year 3, its second year. This was due largely in part to Timmie's tenacity and efforts to promote the program and convince students, parents, and teachers to get involved.

Like Meghan and the New England region, in Year 2 Timmie focused on reaching participants through community-wide events. She continued this approach in Year 3 by presenting at the Asia Pacific Economic Cooperation Conference, the Armed Forces Communications and Electronics Association, the Biggest Little Airshow at the Pacific Aviation Museum, three community park gatherings of the Boys Scouts of America, ten individual schools "open house" events, and outreach activities at the Waikiki Aquarium, among others.

In addition, in October 2011 Timmie organized a week-long professional development workshop Richardson Pool, which is part of the Pearl Harbor complex. The MATE Center supported the workshop by sending staff and materials; the Friends of Hawaii Robotics funded the materials and teacher participation (meals, etc.). Four teachers from different four schools participated. While the turnout was less than expected, the teachers left with a solid foundation as well as enough enthusiasm to spread the word to their colleagues. Timmie also made visits and provided professional development to nine teachers at eight individual schools.

As a result, 26 teams participated in the first annual SCOUT class regional ROV contest, which was held in conjunction with HURC at the Richardson Pool on May 19, 2012. While the majority of the teams represented middle schools, students as young as five took part. Holding the SCOUT and RANGER class events at the same time did was it was intended to do – it allowed the SCOUT teams to see the next step in ROV design and building. At least seven teams and possibly more are planning to move up to the RANGER class next year.

To help generate additional interest in the program and the 2013 competition, in July Timmie organized an ROV "boot camp" at the private residence of one of the SCOUT team teachers. Next year her school is planning to integrate the ROV program into its 5-8 grade curriculum.

What Worked

Connecting with parents, teachers, and students participating in public outreach and community-wide events is what ultimately provided Timmie with the "in" to the public schools. Parents (including teachers who are parents) are amazingly engaged and supportive of their children and their education; it is the nature of the Hawaiian culture. Seeing their children excited about learning is what excited parents, enough so that they contacted their children's teachers/schools and encouraged them to get involved. The students, parents, teachers, and administrators are coming to the conclusion that MATE offers a robotics program like "no other;" they see the direct path to the "real world" and are excited to participate and eager to learn.

Timmie's dedication and commitment to the program is the key to its success – and expansion. In addition to providing professional development and technical support workshops for teachers and students, this coming year she is organizing informational meetings to help teams navigate the competition specifications, engineering and communication requirements, and registration. These meetings will also cover grant writing; the teams can apply for funds to purchase building materials directly from the Friends of Hawaii Robotics.

What Didn't Work and Lessons Learned

While there has been success, it is still difficult to "sell" the program to teachers. Oahu teachers are leery of programs that they see as "complicated" and offering little back-up support. Timmie continues to work to establish trust and communication with both teachers and school administrators. The personalized attention that she is giving to each school along with the workshops and informational meetings she has planned for this fall should help her to gain ground and make inroads into new schools on Oahu. No doubt that the support and funds offered by ROC and the Friends of Hawaii Robotics will also help to convince schools of the backing behind the program.

FLORIDA

The Florida Regional ROV Competition is organized by Erica Moulton, MATE's Summer Institute Coordinator, MTS ROV-in-a-bag (kit) Program Manager, and a Co-PI on the ITEST grant. The contest is supported by Odyssey Marine Exploration, the University of South Florida (USF) College of Marine Science, the MTS-Florida section, Nova Southeastern University, the Pier Aquarium, and Brevard Community College. Erica is also the lead on the Florida ITEST grant activities; Ali Hochberg of the Bermuda Institute of Ocean Sciences (BIOS) supports these activities and serves as the manager of the SCOUT class competition. Sean Moody, a graduate of USF, also supports the workshops and competition events. Project partner Sean Nordquist of

Hillsborough Community College and Nordquist Design manages the purchasing of materials and accounting.

Despite a late start in Year 2, Erica's existing partnerships, rapport with area teachers, and technical expertise allowed her to make significant progress. These partnerships played a key role again this year.

As in Year 2, recruiting teachers began by reaching out to schools and organizations within the city of St. Petersburg that met the ITEST grant parameters of underserved audiences. Now more familiar with MATE and the ROV program, the Pinellas County Science Supervisor granted her permission to incorporate the program into the Pinellas County schools. By the first week of September, three events were scheduled: a meeting with the "Scuba Scouts" and two teacher in-service day workshops, one in Pinellas County and one in Pasco County. The Scuba Scouts and Pasco County decided that the program was not a good fit, but the Pinellas County workshop resulted in two teachers attending a full-day ROV professional development workshop, which was hosted and attended by Madeira Beach Middle School teachers in October.

Erica also contacted a MATE partner school, the Maritime and Science Technology (MAST) Academy, located in Miami. Her plan was to implement Year 2's successful model of working through a MATE partner school/teachers to reach out to and recruit area middle schools. Working with MATE Summer Institute alumnus Melissa Fernandez, Erica and her partners coordinated a full-day ROV design and building program at the MAST Academy for five middle school teachers in Miami/Dade County. Building on that momentum, Erica and Melissa scheduled an ROV workshop during a teacher in-service day in December. Six teachers representing five middle schools participated. These teachers were then encouraged to work with their middle school students to build ROVs for the "Ocean Gate Marine Science Days" scheduled for March. Ocean Gate's mission is to expand humanity's understanding of the world's oceans through exploration, education, and outreach. The Marine Science Days allowed students to learn about marine technology, such as Ocean Gate's *Antipodes* manned submersible, and gave them the chance to fly their ROVs in the MAST Academy swimming pool. All six teachers from the workshop and their students took part.

While working on integration of the program into other schools, Erica ran basic ROV building sessions at a regional Maker Faire and at the Crochet Coral Reef Project. Exposure during these sessions resulted in an invitation to lead an ROV session at USF's Clam Bayou Education Center (described below).

During the 2012 ITEST PI Summit Erica connected and forged a new partnership with the Miami Science Museum. The Museum was looking to further integrate its STEM programs into area schools as well as within its summer programs for at-risk students. As a result, in May the Museum hosted an ROV professional development workshop for six outreach educators from the Museum and the University of Miami who serve the Museum's middle school-age programs. The Museum's ROV program continues to grow and the partnership with MATE is providing an opportunity for the public as well as Museum camp attendees to learn about marine technology. In addition, the public and participants now learn about area middle schools where these STEM programs are offered.

The first of two culminating SCOUT class events was held on April 21, 2012, in conjunction with the annual MATE Florida Regional ROV Competition. Two SCOUT class teams competed. The winning team from Palm Beach Maritime Academy was mentored by Steve Allen, a teacher who started the program in Year 2. In September, David Sellpack and George Bradbury of Riviera Beach Maritime Academy (RBMA) will host the second SCOUT class ROV culminating event for middle school teachers in southeast Florida area. Given the number of middle schools and students engaged in the Riviera Beach and Miami areas, this event is expected to have a larger number of teams participate.

In late May, a professional development day was held at USF's Clam Bayou Education Center. Three teachers participated, including a graduate student funded by USF's College of Marine Science. William Abbott is working in the College of Marine Sciences – Center for Ocean Technology and has an interest in ROVs and AUVs. William's participation in the workshop then allowed him to lead the USF hosted "Oceanography Camp for Girls," ROV activity. William guided 30 middle school girls representing 20 middle schools through ROV design, building, and operation.

What Worked

Again this year, Erica's existing partnerships, expertise, and intimacy with the ROV program and ITEST grant were keys to this region's success. Being persistent and following up with teachers who had expressed interest in Year 2 as well as enlisting the help of teachers already familiar with MATE's ROV program to help promote and advocate to other teachers was also essential. In Year 2, these teachers were David Sellpack and George Bradbury with RBMA. In Year 3, it was Melissa Fernandez of the MAST Academy. David, George, and Melissa also provided local middle school teachers with mentoring and access to resources, including workshops, pools, and tools. In addition, since they had already overcome the barriers to participation (acquiring the necessary permissions to incorporate the program, getting approved for leave time or substitute teachers to cover their classrooms, etc.) within the same school districts, they were able to guide their colleagues through the process. In return, David, George, and Melissa were able to highlight their high schools to prospective students, showcasing where these students can continue their STEM experiences.

What Didn't Work and Lessons Learned

With the help of the teachers from RBMA and the MAST Academy, Erica was able to overcome the most challenging aspect, that being "hurdles" within the school district. Buy-in from administrators was essential to convincing teachers and schools to participate in the program. Starting recruitment early then following up and maintaining regular communication with interested teachers was also important to the region's success.

GREAT LAKES

The Great Lake Regional ROV Contest is coordinated by the Thunder Bay National Marine Sanctuary (TBNMS) and supported by the Sanctuary as well as the Great Lakes Naval Memorial and Museum and Wright View, a commercial ROV company. The Sanctuary is the lead institution for the ITEST grant; Sanctuary education specialist Sarah Waters is the lead on the ITEST activities. Supporting partners include Friends of Thunder Bay National Marine Sanctuary; the Northeast Michigan Great Lakes Stewardship Initiative; 4H-Michigan; Michigan STEM Partnership, Straits Hub; Alpena Community College; the Square One Education Network; and Huron Pines AmeriCorps. In addition to assisting with teacher recruitment, these organizations assist with volunteer recruitment; provide supplies, funds, and/or mentoring for participating schools; and/or lend technical support for the workshops and competition event. The TBNMS Foundation is the fiscal agent for the grant funds.

Like Erica in Florida, Sarah's existing partnerships and knowledge of the program were keys to the Great Lakes' success. Participating in the 2010 ITEST Summer Institute was instrumental in helping Sarah to build upon her knowledge and skills and have the confidence to deliver ROV workshops to teachers and students. In addition, Sarah continued to use the Sanctuary's visitor center as a venue to advertise for the Great Lakes regional competition activities. A new rack card was created that was made available to the 60,000 visitors that frequent the center each year. Sarah and TBNMS staff also built their own model ROV and borrowed a portable tank in order to display and have available an ROV to "fly" at outreach events and at the visitor center.

Also contributing to the region's success was the collaboration with a teacher from the first year of Sarah's ITEST program. Bob Thompson worked with Sarah to develop a program marketed to 5th grade teachers in the four county area surrounding Alpena. The overall objective was to engage students in hands-on activities focusing on STEM principles and encouraging teachers to

mentor an ROV team at their school. Dubbed “Thunder Run,” the program included a lesson plan and underwater event. The lesson demonstrated how to create a simple-circuit fan boat. Fan boat “kits” were put together by TBNMS staff and delivered to participating teachers. Optional, additional classroom visits by TBNMS staff to assist in delivering the lesson were offered. Bob also made himself available to his colleagues for help and advice. Teachers were allowed to keep materials from the kits for future use.

The Thunder Run underwater event took place at TBNMS' visitor center. Nine teachers and 232 students from seven schools participated. Students brought their final fan boat designs to race against each other – individual class times were averaged and the top classroom received a MATE ROV kit and other prizes. During the event, students also attended a basic ROV workshop that included a lecture on ROV basics, building and testing with kits, and information about how to form and enter a team in the SCOUT class regional competition. Following Thunder Run, teachers were offered a second in-school or afterschool enrichment activity kit build or informational session that could include parents or other interested staff and students. Teachers who participated in this event were subsequently recruited to attend a day-long professional development workshop that took place in January. This workshop was delivered by Sarah and Bob Thompson. Sarah followed up with participants to encourage formation of SCOUT teams.

The SCOUT class culminating event was held in conjunction with the Great Lakes Regional ROV Contest. Ten teams led by teachers who had participated in Thunder Run and the day-long workshop participated.

Following the regional event and through an existing place-based learning network called the Northeast Michigan Great Lakes Stewardship Initiative, TBNMS staff connected with a 4H educator who was planning a workshop for 4H educators from 12 counties (the entire northern Michigan region). Sarah also contacted Michigan’s state-wide 4H director to discuss 4H’s new initiatives in STEM learning. In response to these discussions, Sarah offered to provide a cost-free venue for the Northern Michigan 4H workshop in exchange for the opportunity to showcase MATE ITEST ROV opportunities at the event. The organizers blocked a two-hour session for a basic ROV workshop, which was presented by Sarah and TBNMS staff, in June 2012. Since the workshop, three of the participants have followed up with Sarah to ask for additional presentations and materials for their students.

What Worked

Again, the Sanctuary’s existing partnerships and outreach events played key roles in disseminating information about the ITEST activities and competition and recruiting participants. Thunder Run worked exceptionally well to recruit first-time teachers. One of the reasons Thunder Run was very successful was timing; teachers were encouraged to provide the lesson during Michigan’s “MEAP Testing,” a yearly student assessment in math and reading that occurs over several days in the fall. Michigan teachers often have “down time” in between testing where a hands-on, stand-alone activity such as this is easily introduced, worked on, and followed up with a half-day field trip.

Consulting teachers from last year to determine dates for workshops and activities kept the program from conflicting with other events on the local school calendars. Keeping the professional development workshop at a very simple, beginner level eased teachers into the program and gave them confidence to deliver this STEM activity to their students. Sending teachers home with a working vehicle at the end of the workshop helped to ensure that students had a “base” vehicle to work with; from there they could literally expand and build upon it to arrive at a competition-level ROV. Paying for travel to the workshop and being flexible to kit-building workshops to schools and afterschool groups also helped boost participation. Although time consuming, Sarah found that personally following up with teachers after the workshops and student outreach worked particularly well at keeping schools engaged and progressing with the program. Providing multiple pool and work sessions in the spring resulted in a number of very successful and prepared teams at the regional event.

Looking at the success of the Wisconsin regional and international events, the Great Lakes piloted a live broadcast from the competition. Teams were very excited to participate; Sarah and her partners anticipate increasing their efforts with the broadcast. This year the region enjoyed a boost in support from industry professionals and community college and university partners. With the start of a new marine technology program at Alpena Community College, Sarah hopes to see industry and academic support continue to grow over the next year.

What Didn't Work and Lessons Learned
Attending large, community-wide outreach events locally and in metro Detroit area raised awareness, but how that translates into direct participation in the program remains to be seen. Sarah and her partners will be examining their impact. Hopefully, like the New England and Oahu regions, she will see an increase in the number of schools requesting to participate in the program and a growth in the number of teams participating in the regional contest.

However, growth can bring about a new challenge – managing it. This year, the SCOUT class was almost too large to in conjunction with the RANGER class at the Great Lakes Regional ROV Contest. The region continues to struggle with timing as volunteers are limited and several of the SCOUT team mentors and parents also lead or help with RANGER teams. Because they travel between 4-5 hours to attend the competition, these mentors and parents want the SCOUT and RANGER teams to compete on the same day. Sarah and her partners will work to try and refine the logistics, especially as they anticipate SCOUT class participation to continue to rise.

Another challenge is having enough qualified staff to provide workshops, outreach, and technical support to teams throughout the year. The hope is that Sarah can continue to recruit capable personnel from her partner institutions as well as students from the new marine technology program at Alpena Community College. Sarah is also hoping to empower teams to fundraise on their own for materials and travel support so that they can continue to participate even after ITEST funds end.

NEW ITEST REGIONS: TEXAS, BIG ISLAND, SOUTHEAST, AND MIDWEST

TEXAS
The Texas Regional ROV Contest is coordinated by the personnel at the NASA Johnson Space Center (JSC)/JSC's Neutral Buoyancy Laboratory (NBL) and supported by the NBL, the University of Houston, Lee College, and San Jacinto College. The University of Houston is the lead institution for the ITEST grant; Karen Cohen from the university's Coordination of Robotics Education (CORE) is the lead on the ITEST activities. CORE provides education and outreach to students. It uses robotics as the tool to motivate students to study STEM fields throughout their education and to pursue STEM-related careers. Karen is supported by NASA JSC's Lisa Spence, Lee College's Ike Coffman, and San Jacinto College's Angie Hughes. Angie is actually a NASA liaison working with the college on STEM initiatives. The Houston Independent School District supported workshops by providing facilities, personnel, and equipment. The University of Houston is the fiscal agent for the grant funds.

Karen recruited participants for the ITEST activities from CORE's 146 existing FIRST LEGO League (FLL) middle school-aged teams. These teams are mentored by teachers, parents, or representatives of community groups like the Boy and Girl Scouts. These teams participate in FLL in the fall, so participating in MATE in the spring was a good match for their school calendars. Karen reached out directly to the mentors and also posted the opportunity to CORE's web site and through its listserves. In addition, Karen made several lunch-time presentations to local schools.

The professional development workshops for teachers and the outreach workshops for students were not held separately but rather as simultaneous offerings for both. The first workshop was a MATE SCOUT class informational meeting held at the University of Houston in January. This 2-

hour meeting introduced interested teams to the MATE SCOUT class requirements and competition event. A full-day SCOUT class ROV design and building workshop was held at Waltrip High School on February 25th. Richard Lipham, a robotics teacher at the high school and a MATE competition "veteran," was recruited by Karen to serve as the lead instructor; he also arranged for the school to host the event. Teachers and mentors participating in the workshop left with a working ROV, tools, materials, and equipment to continue the project with their students.

The culminating SCOUT class competition event, the UNDERWATER ROBOTICS RODEO, was held separately from the Texas Regional ROV Contest, mainly because of the logistics involved in having new platforms built to accommodate the mission props in the NBL pool. The rodeo took place on Saturday, April 28, 2012 at a Houston area middle school. Nine teams representing seven schools and organizations participated. In addition to the competing teams, Karen invited future potential teams to attend. To provide these teams with a hands-on experience, she and her staff incorporated 10 experiment and activity stations where they could learn about buoyancy and flotation placement, frame design and hydrodynamics, motor placement, materials, etc. As such, Karen used the event as an educational opportunity as well as an opportunity to generate interest in the program for the coming years.

What Worked

Karen's position as the CORE program manager was key to Texas' success. CORE added underwater robotics to their collective of programs and promoted participation to its existing network of schools, students, teachers, and parents. Karen and her staff's experience offering robotics workshops and coordinating events allowed them to easily take on and implement ITEST ROV activities. CORE's infrastructure and existing online registration systems for workshops, school visits, and competition events made management of the program logistics relatively effortless.

Parents were encouraged to attend and participate in all events. As mentioned previously, several of the teams were mentored by parents. Their involvement and support no doubt kept their students involved and on track towards completing their vehicles for the rodeo.

The existing partnerships with NASA and the two area community colleges were also key. These partnerships assisted with volunteer recruitment and provided access to technical support and resources. They also facilitated contact with the MATE competition "veteran" teacher who lead the workshop in February and secured his school's facilities to support it.

What Didn't Work and Lessons Learned

While the existing partnerships contributed to the region's success, they also provided some challenges. The university and the two community colleges involved did not always speak the same "language" when it came to things like reimbursing for supplies of other event costs. Although they have like-minded missions, getting these partners to work together and towards their common goals took the involvement of the ITEST PI. The hope is moving forward that the "growing pains" of these new collaborations have subsided.

BIG ISLAND

The Big Island Regional ROV (BIRR) Contest is coordinated by the personnel from the University of Hawaii's Institute for Astronomy (IFA) and Penny Pung, a Big Island educator whose involvement in the program is a result of her daughter's participation on an ROV competition team. With support from Darryl Watanabe's of IFA, Penny is the lead on the ITEST activities. ITEST and competition events are supported by the Hawaii Electric Company (HELCO), the W.M. Keck Observatory, the NASA Infrared Telescope Facility, the University of Hawaii, the MTS-Hawaii section, and the Hilo Laupahoehoe Waiakea (public school) Complex. The MATE Center is the fiscal agent for BIRR's grant funds.

Two different approaches were used to recruit teachers to participate in the ROV program. One approach was through the standard procedure of contacting school district superintendents and asking them pass on the information to their principals, who would in turn pass on the information to the teachers. The second approach involved attending various STEM functions held on the Big Island. These included the First Lego League contests, Astronaut Ellison Onizuka Science Day, and the 4th Annual Ocean Day. Seven teachers were recruited through these STEM functions, while none were recruited through contact with school district administrators.

Two professional development workshops were held at the IFA. The first workshop was held on February 4, 2012 and the second on February 25, 2012. The first workshop was the annual BIRR kick-off event, where the recruited teachers and their students as well as past teams were invited to take part. This workshop focused on the 2012 competition mission theme and tasks and provided teams with the opportunity to see the mission props first-hand. The kick-off also included demonstrations of ROVs from previous competitions.

The second workshop was carried out with additional help from a previous University of Hawaii at Hilo's EXPLORER class ROV team member. At this workshop teachers built their own ROVs using the reusable kits provided by MATE then completed a mission by retrieving a simulated crab. Darryl taught them how to solder their switches, among other basic electrical skills, and guided them through the construction their control box.

Two area high school students were recruited to serve as mentors at one of the ITEST schools. Both of these students were veterans of the ROV program, one having six years of experience with participation in two international competitions and the other with five years of experience and participation in three international competitions. Other ITEST schools received logistical and technical assistance via e-mail communication, opportunities for one-on-one guidance at IFA, and a pool practice session opened to all teams prior to the BIRR competition.

The SCOUT class competition was run simultaneously with the RANGER class at the BIRR event on April 28, 2012. Twelve teams representing seven schools or organizations participated in the SCOUT class. Of the teachers recruited specifically for ITEST, two formed SCOUT teams. Four (from Honoka'a High School, Hawaii Preparatory Academy, Konawaena Middle, and West Hawaii Exploration Academy) felt comfortable and confident enough to form teams to compete in the RANGER class. The remaining teacher was unable to make the commitment this year due to time constraints, but has expressed interest to participate in the future.

Because of the large number of teams participating in the SCOUT class, Penny and Darryl divided the awards by grade level. As a result, more teams were recognized for their accomplishments, which was very well-received by the participants and spectators. It was showed that age does not dictate success, as some of the younger students scored higher than the older ones.

Many of the teams that have participated in the past continue to participate thanks to the dedication of the teachers and mentors who have supported students throughout the process. Darryl himself originally became involved with the ROV program by being a mentor for his son's ROV team, and, as noted earlier, Penny also became involved through her daughter's participation on an ROV team. The same applies to the students who show as much dedication in continuing on through the years. Regardless of their success, these students continue with the program in the hopes of improving and building upon their knowledge and skills and move from middle to high school and from the SCOUT to the RANGER class. For several, the ROV program as become a family affair, with siblings following in the footsteps of their brothers and sisters and parents behind them providing encouragement and support.

What Worked

Participating in other STEM-themed events provided the best form of recruitment by providing a receptive audience. Students, teachers, and parents who were already interested in robotics and

science were present at these events. In addition, having the MATE ROV kits made it easier when running the workshops as everything was prepared, color-coordinated, and easily accounted for before and after use. Running SCOUT class teams simultaneously with the RANGER class teams allowed the BIRR competition to run more smoothly, namely because there were more SCOUT teams than RANGER teams. The SCOUT competition engaged both RANGER teams and spectators while the RANGER class scores were being calculated.

What Didn't Work and Lessons Learned

Recruiting new teachers through the "proper" protocol of contacting individual Department of Education superintendents and asking them to disseminate information to their schools did not yield any interest from teachers. This was unfortunate as this would seem to be the practical way to spread the word to a large number of teachers. However, given that most workshops presented by the district are "required," it is not surprising that teachers did not respond to one that was "optional" and perhaps less encouraged by administrators.

To help prevent team attrition, Penny and Darryl plan to begin recruitment sooner and organize a fall "warm up" for new and returning teams. The idea is to offer monthly workshops where the students build a working ROV and participate in an informal, fun competition event focused on completing a simple task. Not only will this give teams a leg up, it will also provide them with an ROV activity to keep them engaged in the program before the 2013 missions are released. In addition to preventing drop-outs, it is believed that the earlier that teams start, the more time they will have to "fine tune" and work out any issues with their vehicle, technical report, poster, and engineering evaluation. Starting earlier will also allow for paperwork, including registration and waivers, to be initiated and completed in advance of the event.

In addition, in the future, Penny and Darryl will work to set up a "midpoint" workshop that would require those on the east side of the island to travel halfway to the west side in order to "meet in the middle." The hope is that this will reduce the burden of traveling across island for teams to attend workshops and for the coordinators and volunteers to organize and support these events.

SOUTHEAST

The Gray's Reef Southeast Regional ROV Competition is coordinated by the Gray's Reef National Marine Sanctuary in collaboration with the Georgia Aquarium. Cathy Sakas, the Sanctuary's Education Coordinator and Jody Patterson, a Sanctuary education specialist, are the co-coordinators of the event as well as the co-leads on the ITEST grant activities. Support for the competition and the ITEST program are provided by the Georgia Aquarium, the University of Georgia's Marine Extension and Aquarium, the Army Corps of Engineers, Savannah State STEM 360 and Biology Program, the Georgia Technical College-Savannah Campus, and the U.S. Coast Guard Air Station in Savannah. The MATE Center is the fiscal agent for the Southeast region's ITEST grant funds.

In this, its first year of implementation, Gray's Reef National Marine Sanctuary staff developed the "Sea Turtle Sprint" to work with underrepresented students in Chatham County, GA and offer them the opportunity to participate in marine-related STEM programming outside of the classroom. The goal of the program was to build the infrastructure for an entry-level ROV competition class to participate in the Gray's Reef Southeast Regional Competition by providing professional development and student support workshops as well to increase ocean awareness through ROV-focused STEM curriculum materials. Through relations with county school administrators, Cathy and Jody were able to disseminate information about the workshop series, relate the program with Georgia teaching standards, and recruit Title 1 middle school educators who in turn recruited their students to participate. In an effort to further involve underrepresented communities, the Sanctuary partnered with the West Broad Street YMCA, a long standing caregiver and community service provider, whose location was chosen because of its proximity to area schools as well for its pool and workshop facilities. A copy of the Sea Turtle Sprint flyer is included within the Addenda.

The workshop series began on January 19 and continued every Thursday evening from 5pm – 8pm thereafter through February 16 and engaged teachers along with their students in the basic building of ROVs using PVC pipe, bilge pump motors, and pre-wired control boxes. In addition to the engineering component of this build out, the teams were challenged with integrating anatomical aspects of sea turtles into their designs. Over the duration of the workshop, teachers and students were given an overview of Georgia sea turtles, the challenges that these endangered and threatened species face, their life cycles and the Atlantic gyre they spend most of their lives in. A marine biology student with Savannah State University assisted workshop participants with their ROV sea turtle likeness and helped them to "think" like a sea turtle in relation to movement in the water column. Teams were given pool time practice to learn piloting techniques and adjust the buoyancy of their vehicles.

Materials provided to teachers participating in the workshop series included a ROV for classroom use, a NOAA Discover Your World activity book, a *Build Your Own Underwater Robot* book, and posters and videos for the classroom. Students took home posters and videos from Gray's Reef National Marine Sanctuary and ROV calendars and "squishies" from the MATE Center.

Cathy and Jody also arranged a field trip to the historic Savannah Riverfront to explore a French schooner operating as the research vessel *TARA*. Scientists on board were conducting a world-wide plankton assessment using state of the art technology to study these organisms that make up the base of the food web and are environmental indicators of climate change. This provided an opportunity for workshop participants to engage industry professionals in the field about their research and life at sea on a working research vessel.

The culminating event for these students was the Sea Turtle Sprint ROV Competition and STEM Career Expo, which was held separately from the annual Gray's Reef Southeast RANGER class competition. The Sprint took place at the YMCA on Saturday, February 25. During the event, the teams played a "board game" on the bottom of the pool by rolling the dice, piloting their ROV sea turtle from their beach nest into the ocean, and encountering the man-made and natural threats faced by Georgia sea turtles along the way, until they finally reached the safety of the reef where they could rest under a ledge. Rounding out the Sprint was the "STEM Career Expo," where local universities and organizations showcased their STEM education programs and careers. In addition, a group of students from Savannah College of Art and Design (SCAD) attended and filmed the events with the goal of producing a documentary about the workshop and competition as well as what NOAA aims to achieve by promoting the study of STEM.

Teachers who participated in the Sea Turtle Sprint volunteered to serve as judges in the Gray's Reef Southeast Regional Competition, which was held on April 14th. This allowed them to get a better sense of the event and, more importantly, what their students could achieve if they continue with the program. Several teachers also applied and were accepted to attend the ITEST Summer Institute in Monterey. All expressed an interest in starting formal ROV programs at their schools in the coming year.

What Worked

Workshop participants learned to build and ROV then race their flying "sea turtle" submersibles in the pool around man-made obstacles and natural threats in order to reach the safety of the reef. Using this sea turtle theme, the Sanctuary was able to infuse its conservation message, raise awareness of environmental issues, and demonstrate how technology can be used to help solve real-world problems. The hope is that the teachers and teams who participated in the Sprint will move on to the Gray's Reef Southeast Regional Competition in future years.

The workshop series, field trip with visiting researchers, and "sprint" event went well. For the first time coordinating a SCOUT class event, there were few challenges that Cathy and Jody could not accommodate. This is due in part to Cathy and Jody developing a trust and rapport with the teams, involving organizations from the community, and recruiting a committed corps of volunteers.

What Didn't Work and Lessons Learned
The STEM Career Expo was less attended than expected, namely because the participants choose to stay on the pool deck and watch their fellow teams compete. One idea for next year is to hold the Expo in a different location, as opposed to in the gymnasium with the team workstations and posters.

MIDWEST
The Shedd Aquarium-Midwest Regional ROV Competition is coordinated by the John G. Shedd Aquarium and supported by the supported by the Aquarium and the Illinois Institute of Technology. The Shedd Aquarium is also the lead institution on the region's ITEST grant; Aquarium Science Educator Miranda Kerr is the lead on the ITEST activities.

The Shedd Aquarium's infrastructure and existing relationships with area teachers were keys to its success. The Aquarium started a partnership with Chicago Public Schools (CPS) in 2009, the year it established its regional contest. The goal was to recruit CPS teachers to mentor afterschool ROV clubs. Shedd provided the training, while CPS provided the teacher stipends. In 2011, as CPS funding decreased, it was unable to support teacher stipends. Fortunately, some of the teachers were in their second or third year in the ROV program and chose to continue to participate, especially knowing that ITEST funds would support supplies and materials for their classrooms. The Shedd recruited additional teachers through word of mouth and through information presented at its annual Educator Open House.

With ITEST support, the number of Shedd's "partner schools" increased from eight to 17 in this, its first year of ITEST implementation. Of those, 12 were elementary or middle schools that serve students in grades 5-8; of those 12, five were schools new to the ROV program. Each teacher/school was responsible for student recruitment. Participation ranged from six to 23 students in a club.

Two professional development workshops for the teachers were held at the Aquarium's Education Center. The first was a two-day workshop offered November 4 – 5, 2011; the second was a one-day workshop offered January 21, 2012. As a follow-on to these workshops, Miranda and other Shedd educators provided additional support to the partner schools throughout the school year. A staff member visited each of the schools one to three times, depending on the need and logistics. During these on-site visits, they answered questions, provided feedback on ROV progress, and helped with pool test runs. Shedd also enlisted the experienced teachers in the training of their peers. During the summer of 2011, a teacher with multiple-year participation in the program spoke at Shedd's ROV summer professional development session. In 2012, another teacher partner will take the lead role, working with Shedd staff to help facilitate the summer week-long training program.

On March 3, 2012, all students from the partner ROV club schools were invited to an event at Shedd. The goals of the event were to 1) connect the ROV club students to the Aquarium; 2) build excitement and buy-in for the ROV competition; 3) provide an opportunity for students to make connections with their peers in ROV clubs at other schools; and 4) expose students to career opportunities involving the use of ROVs. During the event, students had a chance to see a mock-up of the ROV competition props and ask questions about the missions. Shedd Aquarium Fishes staff described their coral transplant field work in Florida at the site of a dock slated for demolition and compared it to the coral transplant process the students would use for the ROV competition. Students heard a presentation from an educator who participated on a research cruise with ocean explorer Bob Ballard and the Institute for Exploration and had the opportunity to use ROVs to discover ancient shipwrecks. As a culminating activity, the teams were given an ROV design challenge. Presented with ROV kits and access to pieces of PVC pipe and connectors, the ROV club teams were tasked with designing an ROV for an aquarium exhibit and answering questions about the engineering of their design.

To eliminate the issue of transportation as a hindrance to participation, Shedd funded a bus to bring students and teachers from each partner school to this club event as well as to the regional competition. Parents were invited to attend both events and were able to ride on the buses with their children.

When visiting partner schools, Shedd staff had the opportunity to talk with middle and high school students about their ROV projects, answer their questions, and witness first-hand their excitement in learning physics. The students demonstrated an impressive commitment to their projects as they generated ideas for designing the robot that could accomplish the mission tasks. They spent a great deal of time after school working on the construction and wiring of their ROVs, hours in which the students utilized and developed critical STEM skills. To quantify the impact the ROV program can have on the development of these skills, consider that if, on average, the approximately 210 students from 17 partner schools worked on their robot project two hours a week for 10 weeks, the total number of hours spent is over 4,200.

The culminating SCOUT class competition was held as part of the Shedd Aquarium-Midwest Regional ROV Competition. Five teams from Shedd's partner schools participated. The SCOUT mission took place at the shallow end of the pool, while the RANGER missions took place in the deep end. Posters were displayed together in the adjoining gym, which allowed for interactions between the two classes and gave the new students the opportunity to learn and get ideas from past participants.

What Worked

Shedd's existing relationship with CPS and its partner schools made recruitment and implementation of ITEST activities an easy process. Based on lessons learned, this year the focus of the professional development days shifted from instructing the teachers on how to build an ROV, to giving them the skills to teach their students how to build one. Shedd educators used some of the techniques from the 2011 summer workshop to demonstrate methods of teaching ROV components to students. Staff also talked more about club structure and setting up calendars. Going forward, Shedd plans to continue to expand this logistical component, equipping teachers not just with the content, but with tools for bringing it to their students. In addition, Shedd staff is investigating ways to accommodate the various experience levels of the teachers, such as developing separate professional development training groups based on the number of years of participation in the program.

The videos on Shedd's new ROV Wikispace page give great insight into what the teachers thought about the program. The video on the main page shows Shedd educators working with teachers to build an ROV (http://sheddrov.wikispaces.com/). When the students had the chance to share thoughts and ideas, writing on large post-its, they specifically mentioned that they liked the opportunity to work with their peers and get to know their team as they created the robot. They were also very excited about the opportunity to hear the educator who used ROVs to look for shipwrecks. Students felt strongly connected to the ROV building when they had the opportunity to learn about a real-world ROV that carried out similar tasks to those required in the competition. Many teachers noted how valuable the March 3rd event was for their students to have the chance to see the mission set-up, hear about real ROVs, and practice building an ROV. The experience gave the students a broad introduction to ROVs and encouraged them to want to learn more.

What Didn't Work and Lessons Learned

The goal of the program is for the students to focus on the participation and the experience of building an ROV. During the course of the project, however, Miranda and Shedd staff noted that several of the teams seemed to focus too much on the competition and lost out on the fun of the learning experience. In 2011, Shedd hosted a pool event where teams participated in a practice run of the competition mission and a set of games in the shallow end. Teams enjoyed the chance to try out their ROV without the pressure of the official competition. Some of the games were designed to encourage teamwork, such as having multiple ROVs work together to gather ping

pong balls that spelled out a message. Incorporating a similar pool day into future ROV programs would contribute to a more playful, team approach to the competition. Teachers also need to be coached to help their students focus on the experience of building an ROV and learning STEM topics.

In addition, due to the increased number of partner schools and busy schedules, direct contact between Shedd staff and students was, for some of the partners, limited to one visit per school. An adjustment to begin the school visit schedule in November rather than later in the school year would facilitate more contact. The Aquarium's new ROV Wikispace page where teachers and students can post questions will also help to provide access to Shedd staff without the necessity of a school visit. In the future, it may be feasible to organize several virtual meetings throughout the spring, where students could log in online to ask questions about the competition and the building of their ROVs. The addition of web cams would enable program staff to see the actual ROV projects and better assess the students' progress.

SUMMARY OF DEMOGRAPHIC AND IMPACT INFORMATION

According to the demographic data collected via surveys (N=443), the students were about one-third female (35%), forty-three percent (43%) were of minority backgrounds, 41% came from high poverty areas, and 2% reported that they had disabilities requiring accommodations. More than half (56%) of the teachers working with ITEST teams were female, 38% were of minority backgrounds, and 8% indicated that they had a disability. Among the judges completing surveys (N=96), 59% were female, 21% were of minority ethnic backgrounds, and 5% marked that they had a disability. (See the evaluation report included with the Addenda for specific details and more information.)

Eighty-eight percent (88%) of the teachers (N=83) responding to post-professional development workshop surveys rated the usefulness of the workshops as "excellent," while 11% rated it as "good." Ninety-eight percent (98%) said that they felt very or somewhat comfortable facilitating STEM learning experiences for their students after the training, and 82% indicated that the training had addressed their concerns about mentoring students in designing and building ROVs. Eighty-three percent (83%) of the teachers felt more committed to participating in the competition. When asked how MATE could help ensure that the ROV competition process (designing, building, and competing) is a good experience, teachers offered the following answers:

- *Providing mentors/instructors to help guide the process, instruction manual. This training was a great way to get started with it.*
- *Access to resources*
- *More training on additional types/techniques*
- *Follow-up facilitation with group of students available for Q&A once we start the process*
- *Let me attend a longer workshop.*
- *Be available to answer questions and provide help when needed.*
- *Mentoring. Website tutorials.*

All of these requests were or are being addressed by the post-workshop support (mentors in the classroom, topical workshops for students, the opportunity to participate in the ITEST Summer Institute) provided by the regional coordinators and the work-in-progress complementary online materials (see Summary of MATE Center Support below).

In post-competition student surveys, 81% of the respondents (N=443) reported an increased knowledge of marine-related STEM careers as a result of the ROV project. More than half (56%) of the students stated that their ROV project made them more interested in a marine career. Seventy-five (75%) percent of the students indicated that their ROV project made them want to

learn more about ocean STEM. Comments included on the surveys demonstrate students' enthusiasm for the program and STEM:

- *Don't stop this program EVER! I cannot put into words how much I love this competition. For the two years I have participated, I have learned more about constructing circuits and building than I have through any class or extracurricular.*
- *This was one of the best learning experiences I've had. Not only did I learn how to manage an ROV, I became more aware of fields opening in science and engineering.*
- *I have learned so much about robotics and the value of teamwork and friendship. It is in unforgettable experience that I will treasure always.*
- *Before this program I didn't know what to do with my life, but now I do.*

Among the teachers/mentors who completed post-competition surveys, 98% of the respondents (N=90) reported that they observed improvements in their students' STEM knowledge and skills, while 92% observed increases in their students' skills in team building, problem solving, and/or critical thinking. Ninety-one percent (91%) of the teachers/mentors felt that the ROV program provided a valuable venue to help prepare their students for careers in marine science & technology. Comments included on the surveys further emphasize the benefits teachers felt that the project provided to their students:

- *My students and myself loved the program, particularly the integration of STEM, the environmental theme and history (Diving into History). I am excited about growing our school's ROV program into a possible elective course at our school as we expand into the high school grades. Thanks for your (MATE) support.*
- *Some students just ran with the ROV curriculum, exceeding my expectations. It will remain part of my curriculum.*
- *This has definitely been an enriching educational experience for my students. They are excited and looking forward to ROV competition next year and are already discussing designs.*

The results of parent surveys were also encouraging. Ninety-one percent (91%) of the parents surveyed (N=220) stated that building an ROV has made their child more interested in STEM; 81% responded that participation in the program had made it easier to picture their child in a STEM career. Sixty-eight percent (68%) of parents reported that their children were better able to work with others; 61% indicated that their child's self-confidence had improved. Ninety-nine (99%) percent of the parents rated their children's experience building and competing with an ROV good or excellent. When asked how valuable the competition has been for the educational development of their child, 71% indicated that it was extremely valuable while 26% stated that it was quite valuable. Parents' comments about the changes that they have seen in their children as a result of the ROV project included the following:

- *It was like a booster shot of wanting to learn. Best learning experience we've ever encountered.*
- *I'm excited about the science, technology, and math skills that have been acquired. Equally important, skills have been developed in working with others to accomplish tasks.*
- *Massive increase in a hunger for knowledge, looking up and researching information.*
- *I have seen just his excitement in all parts of engineering just soar, plus his creativity and understanding of how engineering affects our lives.*

Judge/volunteer surveys were administered in 10 regions. Of those who responded (N=133), 97% agreed that the competition helps motivate students to learn science, technology, engineering and math, while 94% agreed that it helps strengthen students' 21st Century Skills, such as teamwork and critical thinking. Ninety-five percent (95%) felt that the competition helps prepare students for careers in marine science, technology, and engineering. When asked to

rate their overall experience volunteering with the competition, 97% rated it as good or excellent; 93% responded that it was a rewarding experience.

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

SUMMARY OF MATE CENTER SUPPORT

In addition to financial resources via the grant funds, the MATE Center provided each region with the draft curriculum; samples of workshop agendas, competition scoring templates; and guidance and feedback via individual phone calls, conference calls, webinars, and e-mails on both a scheduled and an as-needed basis. We also provided them with ROV kits as well as technical and logistical (i.e., ordering material and supplies as well as prop-building materials and individual instruction on how to assemble) as requested. In addition, we worked with other personnel from organizations, such as the University of Houston, to ensure that the grant would run smoothly; in the Southeast and Hawaii regions, we managed their grant funds. From the information provided in the regional reports, the coordinators were satisfied with the level of support that the MATE Center provided.

Based on 1) feedback from regional network coordinators and teachers (ITEST and "non-ITEST" teachers) as to what would help to "sell" the program to other teachers and administrators and 2) what we learned regarding the type of career resources that teachers feel are needed to better interest and engage their students in STEM, we launched a pilot video project to document students as they progress through the ROV engineering and construction process. See Objective 2 below for more information.

In addition to this video project, we have started to amass videos, PowerPoint presentations, activities, and links to web sites that complement the instruction and hands-on experience of the ITEST Summer Institute and are aligned with the *Framework for K-12 Science Education and Next Generation Science Standards* that emphasizes the integration of science and engineering like never before. The plan is to organize these resources into online, topical curriculum modules that follow the Institute's design and building process. These, along with the curriculum being developed under this grant (see section below), will be posted to the ROVER web site and disseminated. Given our project's extensive geographic reach, we feel that adding this complementary, online component is the most efficient and effective way to support teachers after they leave the professional development experiences.

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

Given the diverse nature of the organizations coordinating the regional competitions, this year we experimented with two curriculum models. The first, led by Curriculum Development Specialist DeDee Ludwig, formerly of the Shedd Aquarium and now with San Francisco's Exploratorium, produced a draft ROV-focused STEM curriculum that is tied to national education standards that is especially useful in afterschool and informal learning environments. Rather than 4 modules as originally proposed, the curriculum is a collection of "chapters" that can be used together (in or out of sequence) or individually as stand-alone activities, depending on the intention, time frame, needs, and interests of the teacher and students. The lessons are split into two different types: knowledge and building. Knowledge lessons are focused on math, science, and technology and help students gain the knowledge and critical thinking skills needed to create each component of the ROV. The building lessons include basic engineering principles and are designed to help as students actually construct the ROV.

The curriculum was provided to teachers participating in the 2010 and 2011 Summer Institutes and in Year 2 regional workshops, with the intention that it would be used to support implementation of the ROV project and participation in the competition. The project's evaluator,

PI, and DeDee worked together to develop a feedback form that was then disseminated to these teachers. This feedback was used to inform the next draft of the curriculum.

The curriculum was also reviewed MATE Center staff, beginner and intermediate level Summer Institute instructors, and two content/pedagogy experts: Curt Gabrielson, Coordinator of the Watsonville Environmental Science Workshop, and Melody Randel, a retired secondary school math teacher from the Pajaro Valley Unified School District (PVUSD). In addition to content knowledge, both Curt and Melody have extensive experience serving underrepresented middle school student audiences. Their experience with these students in both classroom and afterschool settings makes their feedback particularly valuable, especially from a pedagogical standpoint.

In addition to Curt and Melody, Laura Batts, the Director of Programs at Immersion Presents (see www.immersionlearning.org), reviewed and provided feedback on the curriculum. Laura also contributed content and photos from her pool of Immersion Presents' resources.

The second model explores a more formal curriculum that can be integrated into a school curriculum. Its foundation is the online curriculum modules that follow the ITEST Summer Institute progression (described under Summary of MATE Support above) and builds from there. We recognize that a complete, ready-to-go curriculum that can be adopted by school districts is a key for long term institutionalization and sustainability.

In Year 3 our Pennsylvania regional partners at Villanova University's Mechanical Engineering Department gave us permission to use lessons from their underwater robotics curriculum (see www72.homepage.villanova.edu/aaron.wemhoff/URC/Underwater%20Robotics%20Curriculum.pdf). This curriculum is much more engineering-focused and will help to strengthen this area of both of our models.

The Villanova resources, along with photos and illustrations from MATE's underwater robotics textbook, are currently being incorporated. The goal is to finalize both curriculum models, disseminate them, and evaluate their usefulness with ITEST teachers, project partners, and via the ROVER web site during the one-year, no-cost extension of the grant.

Broader impact: To complement the curriculum, MATE continues to reach out to its network of schools to gather "stories" of how students and teachers are using ROVs for projects other than the competition. With these stories, not only do we want to capture the variety of ways that schools are implementing ROV projects in their classrooms, but also how teachers have made it "work" (i.e., secured buy-in from administrators, gathered funds, set up their classrooms as workstations, evaluated the impact on their student, etc.). We feel that this information, coupled with the videos, photos, and best practices envisioned for the new "SHARE" area of ROVER (see Objective 3 below), will go far in supporting teams and helping teachers see how they can make it "work" at their schools.

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

The second annual ITEST Summer Institute, *ROVER: ROV Education and Resources for the Classroom*, took place July 6 – 12, 2011 at Monterey Peninsula College (MPC). The overarching goal of the Summer Institute was to provide additional instruction to regional ITEST participants and to empower all participants to become knowledgeable regional resources. A total of 20 educators attended.

As proposed, recruitment for the 2011 Institute focused first on the four regions implementing ITEST activities in Year 2. Regional coordinators notified their ITEST participants of the opportunity to attend the ITEST Summer Institute during their professional development workshops. Post-workshop, regional coordinators sent a printed copy and e-mailed a two-page

flyer describing the workshop, including the goals of the session. In addition, Year 1 Summer Institute participants were encouraged to recommend applicants for Year 2.

Another recruitment tool created as a result of lessons learned is the middle school program "highlights" document, which can be used in conjunction with the letter to administrators or can stand alone. The document was designed to appeal to a wide audience – from potential participants to students, administrators, and parents. It includes photos of students and teachers, statistics generated from workshop and post-competition surveys, quotes from parents, and examples of how integrating STEM promotes a variety of learning opportunities. In addition to addressing administrators' concerns and highlighting the achievements of the program thus far, our goal with the letter and highlights document was to allow each ITEST region to provide consistent answers to common questions as well as to remove some of the potential barriers to participation.

As a result of these efforts, recruiting teachers from the ITEST regions was less challenging than in Year 1; we found that personal teacher referrals and recommendations, as well as on- on-one direct contact with the administrative staff of our target audience, greatly assisted in the process.

Twelve middle school teachers from the Year 2 regional ITEST regions applied to the Institute; one from the Monterey region, one from the Southern California region, two from the New England region, five from the Pacific Northwest, one from the Oahu region, 1 from the Florida region and 1 from the Michigan region. In an effort to meet our target number of 20, the Institute was then opened to middle school educators from other regionals and, later, promoted to the entire MATE network of teacher contacts. As a result, we received twelve additional applications and filled the remaining 8 spots with middle school educators connected to either Year 1 ITEST regions or participants from California, Florida, Louisiana, Alaska, and Arizona.

Participants spent 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 toured the Monterey Bay Aquarium, with its ROV exhibit a focal point of the tour, and MBARI to see first-hand ROVs and other ocean technologies and to learn how they are used in research and exploration. Visiting MBARI, talking with engineers, touring the vessels as well as hearing presentations about OceanCareers.com and the Exploring Ocean Careers course provided 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 helped to inform work on Objective 2. (See the Addenda for the 2011 application and agenda.)

Sixteen participants responded to the follow-up evaluation survey. One hundred percent (100%) indicated that the Summer Institute was useful; 94% felt that the Institute gave them valuable ideas to use in their courses. Seventy-five percent (75%) of those responding also felt that the Institute addressed the current technologies used in the marine field and that the Institute provided instructional materials that will help their students become better prepared for ocean-related STEM careers. Open-ended comments from the Institute participants include the following:

One of the best workshops I have attended. The faculty are excellent and engaging, and all the logistics were first rate. By attending I believe my programs will benefit enormously. Thank you for maintaining such a wonderful opportunity for educators.

I can't even put into words how wonderful the ITEST session was. I learned more in this one week session than an entire semester in college. The hands on learning is perfect.

I was exposed to something completely new and different to take back and teach to my middle school students. This course was a reminder and maybe a reaffirmation for me that these hands

on activities are what help our students truly learn. Textbooks should be a resource and not the focus of instruction.

The third annual ITEST Summer Institute*, ROVER: ROV Education and Resources for the Classroom*, took place July 8 – 14, 2012 at MPC. Information about this Institute, including results from the follow-up evaluation survey, will be included within the final grant report.

Recruiting for the 2012 Institute began early in the academic school year and included e-mail reminders to regional coordinators implementing ITEST activities in Year 3 to promote the Institute in their workshops. In addition, there are now a number of teacher "mentors," as Year 1 and Year 2 Summer Institute participants returned home and can attest to the power of the Institute. These past participants were encouraged to recommend applicants for Year 3.

Another targeted effort to recruit teachers took place in September 2011 at the annual MTS/Institute for Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) Oceans Conference and Exhibition held in Kona, HI. Educators in the Big Island and Oahu ITEST region were invited to attend a pre-conference educators' workshop co-sponsored by MTS and IEEE OES and held in conjunction with the conference. Although this session focused on sensors and other underwater technologies in addition to ROVs, it was a great opportunity for participants to meet MATE staff as well as their ITEST regional coordinators.

The October 2011 regional coordinators' meeting held at MPC was the next opportunity to connect with all of the regions to promote the Summer Institute. During the meeting, regional coordinators were supplied with Summer Institute flyers and announcements as well as with copies of the highlights page and letter to administrators.

We also continued to provide access to MATE staff and example teachers at outreach events such as the 2nd Annual USA Science & Engineering Festival in Washington, DC; Underwater Intervention Conference and Exhibition in New Orleans, LA; National Marine Educators Association's annual conference; National Science Teachers Association's annual conference and MATE regional and international ROV competitions.

All total, improved recruitment strategies resulted in 26 applications for the allotted 20 spots in Year 3, a slight increase over the number of applications last year. All 20 of the teachers accepted to the Year 3 Summer Institute were connected to an ITEST region: 3 from Hawaii, 4 from Florida, 6 from New England, 1 from Great Lakes, 2 from Chicago, and 1 from the Southeast.

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 with middle school audiences. Much of the first year was 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? 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.

Querying focus groups of middle school teachers attending the Summer Institutes over the last two years, we learned that the Internet is 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 others. Interestingly, teachers wanted more career videos; however, when we researched general career videos in science and engineering we found plenty of them. Some of them are very professional and were produced by NSF and ABC. It appears that many teachers did not take the time to search extensively for career information so many resources are not known. A number of the teachers expressed the need for career resources that are directly tied to careers and career pathways (i.e., the ROV competition) so that they can better establish the relevance of 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.

Teachers in the focus groups also indicated that they would like to see short videos (1-2 minutes) as an effective way to capture the excitement of students in the ROV competitions and relate the knowledge, skills, and experience gained to continuing education (high school and college) and jobs in the real world. The teachers also emphasized that students, interns, and young people just entering the workforce are some of the most effective spokespersons to communicate with middle school students. In addition, the teachers noted that, since YouTube is often blocked in classrooms, videos should be made available via TeacherTube and on DVD.

Although many career videos exist, few directly tie into the activity the students are involved in. In the case of ROV building and the competition, we have a captive group of students (middle school, high school, college, and university) and volunteer judges, a number of whom are former ROV competition students who are now a part of the ocean workforce, to work with.

In light of this research, we filmed students, parents, mentors, and industry professionals at the 2012 international ROV competition. We are now editing these videos to create a "story" that demonstrates how the competition ties directly to the workplace. We will be posting these videos to the web site this fall and gauging their appeal with students, parents, and teachers.

The *Exploring Ocean Careers* course is currently being moved to the new MATE web site. (See the ROVER section below for more information about the new MATE web site.) Once the class is moved to the new MATE web site, we can provide access to an unlimited number of teachers and students.

We experimented with a new pilot program this past year that encouraged ROV competition students to create their own videos. Six teams in the southern California region were selected to participate in the pilot – three RANGER teams and three SCOUT teams. In January 2012, the teams took part in a workshop with a professional videographer. A total of eight mentors and 23 students attended. Each team was provided with a waterproof video camera to use for the duration of the project. They received training in the use of the camera as well as in storyboarding, filming, editing with iMovie, and distribution. They were encouraged to create videos of no more than two minutes that focused on an experience participating in the competition, a technical lesson, or a marine STEM career. They could use a reality show approach, a news report approach with interviews, or they could make tutorials, music videos, stop motion animation, or follow their own inspiration.

After the workshop, the teams had access to the video instructor via email and phone. She checked on their progress and offered technical support as well as underwater shipwreck footage (the theme of the 2012 competition) that could be incorporated into the students' videos. She also set up a Wikispace where the workshop videos and information were posted. In addition, web pages were set up for team communication and sharing information. By the international ROV competition in June 2012, two of the six teams had posted videos.

Several valuable lessons were learned as a result of the pilot project:

- There was no deadline so several of the teams are still working on their videos. Next year, we will consider setting a firm deadline for completion.
- The main challenge for the teams was finding the time to do the editing, with the many competing academic and extracurricular demands. Next year, we will consider creating a contest (possibly combined with the ROV competition) and offering a prize for the best video.
- The Wikispace was not used by the teams. In fact, most teams did not register for access. We have not decided as of yet whether we will continue the Wikispace. However, if we proceed, the Center will try to hold the kick-off workshop at a site with Internet access so that the teams can register during the event. Alternately, other communication methods/venues will be explored.

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

We provided a list of the nearly 200 new elementary, middle, and high schools (including mailing addresses) that participated in its 2012 international and regional competitions to the Marine Technology Society (MTS). 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.

● Couple efforts with postsecondary academic institutions.

Each of the 12 regions implementing ITEST activities in Year 3 connected with (if they weren't connected already) postsecondary academic institutions within their areas. As these regions carried out teacher professional development, student workshops, and SCOUT contest events, they reached out to these institutions to gain access to program and career information and, in some cases, to combine career awareness efforts. They also incorporated MATE's existing career resources, namely www.OceanCareers.com, into their activities.

"RETURNING" ITEST REGIONS: MONTEREY, SO-CAL, PNW, NEW ENGLAND, MID-ATLANTIC, OAHU, FLORIDA, AND GREAT LAKES

MONTEREY

The MATE Center is based at MPC, which provides Jill Zande, the PI/regional coordinator, with easy access to STEM-related program information, recruiting materials, career guidance tools, and similar "tech prep" programs. Examples of these include engineering and computer science program brochures; PowerPoint slides; "How to Get to College" flyers for grades 6-12 produced by the California State University system; and MPC's Technology Preparation ("Tech Prep") and Upward Bound programs. These resources were shared with teachers during professional development workshops and with students during the ROV competition events. Further, as described in Objective 1 above, the involvement of high school, community college, and university mentors provided examples of students pursuing a STEM-related education and career path. For many of the participants from the Pajaro Valley School District, it also increased their awareness of other, local (that is also smaller and more-affordable) postsecondary schools

besides the University of California Santa Cruz. We are making progress on the Monterey area "map" of the educational pathway that, using the ROV competition to tie it together, leads students from middle schools to high schools to MPC and other, local postsecondary institutions. We plan to finish this roadmap during the one-year, no-cost extension.

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 Objective 1 above, Scott pairs students from his LBCC program with the participating schools. This not only provides specific examples of LBCC's "student products," it also provides role models that demonstrate the potential that the younger students can reach if they stay engaged and choose to purse a STEM education and career. Further, through the ITEST work, Scott has developed a partnership with both LBCC's Tech Prep program and the LBUSD, where he has been invited to present information about his program and his student "where are they now" success stories. This has allowed him to promote postsecondary technical education programs and career pathways beyond the teachers and parents involved in ITEST.

PACIFIC NORTHWEST
Fritz Stahr, Rick Rupan, and Wes Thompson, the co-leads of the Pacific Northwest's ITEST grant, are marine technical professionals at UW. The UW administration continues to support the grant activities by providing access to its facilities and other resources; for example, the teacher and student workshops take place on the UW campus. All of these factors allow teachers, students, and parents to make quick connections to postsecondary opportunities at the university and, beyond that, to potential careers. Presentations at schools by MTS-Puget Sound section members also expose participants to examples of ocean STEM careers. Further, with the expansion into Oregon and the involvement of Linn-Benton Community College students, participants in more rural areas were exposed to a smaller, more affordable postsecondary school option.

NEW ENGLAND
The lead on New England grant is also a postsecondary institution. 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 Objective 1 above, Meghan recruits BCC engineering students to deliver content and instruction to the participating schools. In addition, students from the UMass-Dartmouth and Massachusetts Maritime Academy also serve as mentors. The benefits of this are the same as described above for the Southern California region. As a result of these schools' involvement, Meghan is also able to share information about and make the connection from BCC to bachelor's degree programs. The students also share their stories; one female UMass-Dartmouth student highlighted how her involvement in the MATE competition lead to her interest in the marine technology field and what she is currently doing to prepare herself for a career in this field. Similar to the Pacific Northwest, the involvement of professionals from the MTS-New England section, Lockheed Martin Sippican, and Benthic Exploration provide exposure to careers in ocean STEM fields.

MID-ATLANTIC
The lead on Mid-Atlantic grant is Nauticus, the National Maritime Center. Nauticus' existing rapport and reputation with area school districts, volunteer pool that includes professionals from local technical industries, and partnership with Old Dominion University provide Peter Leighton, the ITEST grant's lead coordinator, with both an enthusiastic participant pool and connections with postsecondary institutions and career examples. To increase exposure to ocean STEM fields, the PI will work with Peter to reach out to and solicit support and involvement from the MTS-Hampton Roads section.

HAWAII-OAHU
The lead institution on the ITEST grant is the University of Hawaii at Manoa and the lead coordinator of ITEST activities is Timmie Sinclair, a former middle school teacher and 2010

ITEST Summer Institute alumnus. Timmie is supported by Mark Rognstad, a sonar engineer within the university's Hawaii Mapping Research Group. Mark reached out to university engineering students and professionals as well as MTS-Hawaii members to get them involved as judges and technical support. Although not a postsecondary institution, Kailua High School had substantive interactions with a number of ITEST schools that included hosting a pool practice session and students from the school's ROV team showcasing their RANGER class vehicle. Through that involvement, the middle school students could see the next "step" on the pathway of ROV education, not to mention learn from near-to-peers. In addition, Timmie has developed partnerships Hawaii Pacific University's Ocean Institute and the Pacific Aviation Museum at Pearl Harbor, two organizations that represent postsecondary educational opportunities and connections to careers.

FLORIDA

The lead on Florida's ITEST grant and activities is Co-PI Erica Moulton. Erica is also MATE's Summer Institute and Florida Regional ROV Contest Coordinator and manages the ROV-in-a-Bag program funded by MTS. Erica connected the region's activities with the USF's College of Marine Science. For example, a recent graduate of the university was hired as an intern to help build, maintain, and disseminate the ROV kits. He also served as technical support during workshops and mentored students and teachers who needed assistance. This involvement provided participants with an example of a postsecondary ocean STEM program and the type of student it produces. Teachers from two high schools, RBMA and the MAST Academy, hosted workshops and provided support to area middle school teachers. This interaction gave the middle school teachers a better picture of the opportunities offered at these two high schools – information that they can then pass along to their students and parents. In addition, RBMA students who are part of the school's ROV team served as judges and technical support during the culminating SCOUT class competition event.

GREAT LAKES

The lead institution for the ITEST grant is the Thunder Bay National Marine Sanctuary and Underwater Preserve. During her workshops and presentations, Sarah Waters, a sanctuary education specialist and the lead ITEST activities coordinator, used existing sanctuary resources (e.g. PowerPoints and brochures) to illustrate how ROVs are used in national marine sanctuaries and to show the connection between ROV work and career opportunities in the Great Lakes region. Students from the engineering program at Michigan Technological University, two of whom are former ROV competitors from a local high school, served as judges during the regional event. Further, two graduate students from East Carolina University who are working as Sanctuary staff assisted during various outreach activities and workshops. In addition, Alpena Community College recently started a marine technology degree program. As this program gets underway, it will be a tremendous resource for student mentors, not to mention an excellent example of a local postsecondary school program where students can continue on their ocean STEM career path.

NEW ITEST REGIONS: TEXAS, BIG ISLAND, SOUTHEAST, AND MIDWEST

TEXAS

The lead institution for the Texas ITEST grant is the University of Houston, which has several engineering degree programs. Karen Cohen is the lead ITEST coordinator. As the university's robotics program outreach coordinator for area K-12 schools, Karen has contacts with a number of local high school students who have very relevant experience and skills. These connections allowed Karen to easily recruit students from the university as well as students from high school robotics teams to assist with the development, instruction, and leadership at the region's workshops and culminating competition event. The NASA Johnson Space Center's Neutral Buoyancy Lab is the host for the Texas RANGER regional ROV contest. While this year's SCOUT competition was held separately from the regional and at a different location, the partnership with NASA enabled the recruitment of working professionals to serve as judges and technical support. In addition, San Jacinto College, a new partner on the ITEST activities, has

several STEM as well as a maritime technology degree program. The college's involvement will no doubt increase in future years, allowing the program to showcase educational pathways at both 2- and 4-year institutions.

BIG ISLAND
The lead institution for the Big Island is the University of Hawaii's Institute of Astronomy. The co-coordinators are Darryl Watanabe, an engineer at the institute, and Penny Pung, a local educator. Through the working professionals that Darryl recruits at the institute, university, and other technology organizations (e.g. NASA Infrared Telescope Facility and the W.M. Keck Observatory, among others), students are exposed to STEM career opportunities on the island where they live. In addition, students on the University of Hawaii-Hilo's EXPLORER class ROV team assist Darryl and Penny at workshops and during the competition event. Like other regionals, this allows the middle school students to see the next step in ROV design and building and postsecondary institutions where they can continue their STEM learning.

SOUTHEAST
Gray's Reef National Marine Sanctuary is the lead institution for this region. Cathy Sakas and Jody Patterson, educators at the Sanctuary and co-leads on the ITEST grant, used their existing partnerships with local universities and organizations to expose students to careers and the academic programs that lead to them. These universities and organizations include the University of Georgia Marine Extension and Aquarium, Army Corps of Engineers, Savannah State University's STEM 360 and Biology Program, the Georgia Technical College Savannah Campus, and the U.S. Coast Guard Air Station in Savannah. Students and working professionals from these organizations supported workshops, offered field trips, and, through a "STEM Career Expo," showcased information about their programs and career opportunities at the culminating "Sea Turtle Sprint" SCOUT class event.

MIDWEST
The John G. Shedd Aquarium is the lead institution for the Midwest region's ITEST activities. Education specialist Miranda Kerr is the lead coordinator of the grant activities. Like other regions, the Shedd Aquarium used its existing partnerships to recruit teachers to participate in the program as well as volunteers to support workshops and the competition event. For example, the Shedd used its "partner" high schools to showcase the next level of RANGER class ROV building. Members of the Aquarium's volunteer corps, which includes science and technology professionals, supported the workshop and served as team mentors and competition-day judges, helping to provide students with examples of local careers. In addition, students from Purdue University's ROV team served as judges and technical support during the competition. They also demonstrated their EXPLORER class vehicle and entertained questions about its design and operation. In this way, the ITEST students were presented with an example of where this program can take them, including enrollment in an engineering program at a nearby postsecondary school.

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 Resource) web site (www.materover.org) was launched in September 2010 with information, resources, communication forums, links to outside sources, social media outlets, and more. The web site was built on the Joomla content management system (see www.joomla.org).

One of the goals of ROVER is to be a portal for existing technical, instructional, and career resources either developed by the MATE Center and its ITEST partners or from "external" sources. To accomplish this, the web site has been populated with the following links:

- 5 ROV competition FAQs
- 3 "help" videos
- 434 ROV Videos
- 10 ROV Images
- 9 ROV News Sources
- 31 ROV How-to Books, Information and Articles
- 6 ROV Blogs
- 4 ROV Online Communities
- 59 ROV Building Supplies/Suppliers
- 16 Archived ROV Competition Information Links
- 9 ROV Internships, Scholarships, & Opportunities
- 40 ROV General Links
- 22 ROV Competition Press Coverage Links
- 11 ROV Team/School Links
- 63 Glossary Entries

Many of these links lead to collections of additional resources, so the actual numbers of resources that can be accessed through the links is much greater than the number of links.

The Google Analytics system that should have been monitoring the web site was not working for the first eight months. This error was corrected in mid June of 2011, during the international ROV competition. Since that time until present, the site has received 43,242 unique visitors (which is defined as the number of unduplicated visitors to the web site during the given time period).

There are other measures to help quantify the impact of ROVER. For example, another goal of ROVER is for it to serve as a "communications hub" that utilizes web features as well as social media outlets to encourage information-sharing, collaboration, and communication among all stakeholders (teachers, students, parents, and working professionals). To that end, statistics are available for the following features and social media:

- Twitter: 264 followers (http://twitter.com/matecenter)
- Facebook: 535 "likes" (http://www.facebook.com/pages/MATE-Center/226625134802)
    - Maximum active users in a single month: 95
- Flickr: 3,223 pictures of ROVs and participants (http://www.flickr.com/photos/matecenter)
    - Total views: 3,300+
- YouTube channel: 229 videos (http://www.youtube.com/MATECenter
    - Total upload views (since May 2007): 41,556
    - Channel views: 9,000+
    - Subscribers: 98
- 2012 ROV Competition Registration: 2,515 registrants total (2,2227 students; 274 teachers/mentors; 14 judges)
- ROV competition FAQ page: 429 posts on 150 different topics during the 2012 competition season. This is a marked increase from last year that can be attributed to our lesson learned, which is to frequently "seed" discussions.

In addition, when visitors accessed ROVER for the first time, they were invited to complete a survey that asked about what type of stakeholder they were (student, parent, teacher, industry professional, or underwater enthusiast), how they have been involved with the MATE Center, and their reason for registering with the site. Between July 1, 2011 and August 27, 2012, 544 users completed the survey. Sixty-nine percent (69%) of those users identified themselves as students; 28% as teachers; 5% as a parent of a student interested in marine technology; 1% as an industry professional; and 7% as an underwater technology enthusiast. The main resource users were seeking when they first visited the site was ROV competition information (93%), followed by technical resources for building ROVs (36%), mentors (15%), career information (14%), and to share information (11%). (Note: Since multiple responses were permitted, percentages add to more than 100%.)

Another goal of ROVER is to be the information and management location for the MATE ROV competition network. The MATE competition site (formerly housed at www.marinetech.org) migrated to ROVER in time for the 2011 competition season. This move made ROVER the one-stop shop for competition information, communication, and participant support.

Again this year, ROVER hosted 100% of the participant portion of the 2012 MATE ROV competition season. This included serving as the portal for team registration. As noted above, more than 2,500 students, mentors, and judges who took part in the 2012 competitions utilized ROVER to register their involvement.

Further, ROVER provided access to the live videostream from 11th annual international competition, which was held June 21-23 at the YMCA Aquatic & Family Center in Orlando, Florida. Parents, fellow students and teachers, mentors, local communities, sponsors, and more could view the action (as well as link to Tweets, Flickr photos, and Facebook posts) by visiting ROVER. According to Google Analytics, there were nearly 10,000 visits during the event dates.

Plans for the upcoming year include migrating ROVER to the new MATE web site platform. Clear Science, Inc., MATE's web developer for the past 14 years and the company that developed and maintained ROVER, moved on from the web development business last fall. After contacting several web development companies, we found Byte Technologies and are currently in the process of redesigning, restructuring, and populating the www.marinetech.org site. We will transition ROVER next, completing the process in time for the November release of the 2013 competition information.

Following the transition, we will continue to add content and features to ROVER. The proposed "Mentor Hotline," a geo-referenced directory of working professionals and the "services" (design reviews, tours of facilities) that they offer, will morph into several different features. The first will link to the "experts' directory" of the Marine Technology Society, where students can search and directly contact industry professionals with the expertise they are seeking. The second will highlight the student-produced videos described in Objective 2 above, while the third will point students to the Ocean Careers web site and its career profiles. In addition, we will create a new "SHARE" area, where students, teachers, mentors, parents, and industry professionals can share their stories (see Broader Impact under the "develop curriculum modules" above), videos, best practices, techniques, curriculum materials, etc. with the larger ROV STEM community. We feel that these features will accomplish what the mentor hotline was envisioned to and so much more.

In addition to content and features, we plan to continue to improve the participant support and administration side of ROVER. For example, the move to the MATE web site platform provides the opportunity to modify the regional contest web site template so that it better suits the needs of the regional coordinators. We will gather input from the coordinators to inform this process. Transitioning ROVER to the MATE platform will place STEM-related curriculum materials and career information for all grade levels as well as technical resources on one site, which will save on duplicate postings and make it easier for visitors to find the information that they are seeking.

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 evaluation findings indicate that the MATE Center's ITEST project is achieving the expected outcomes. The complete evaluation report, including the evaluation instruments and specifics about data collection and analysis, can be found within the Addenda.

REGIONAL COORDINATORS' AND ADVISORY COMMITTEE MEETINGS

Regional Coordinators Meeting

The regional coordinators meetings are of tremendous benefit to ITEST work and to strengthening the entire competition program.

The 2011 MATE ROV competition regional coordinators' meeting took place November 10-11 in Monterey, CA. Based on lessons learned from Years 1 and 2, this regional coordinators' meeting was one-and-one-half days. The meeting was held at MPC, which helped to keep costs down and, for the first time, allowed Matt Gardner to present and gather feedback on the "drafts" of the 2012 competition mission props.

Twenty-three coordinators representing 15 regional events attended. The meeting included a debrief of the 2011 competition season, lessons learned to apply to "next year," suggestions for improvements, safety issues and concerns, volunteer recruitment, and plans for 2012. In particular, emphasis was placed on "what it takes to be a MATE regional," which includes consistency across the regional network, from the props used on the underwater missions to judges' and volunteers' preparation. Similarly, we discussed the support that coordinators can expect from the MATE Center. This support includes "personalized" banners for each regional contest; a more step-by-step set of prop-building instructions; and a shopping list of prop parts organized by task then summarized into one long list with cost estimates.

In addition to the mock-ups of 2012 competition props, Jill Zande and Matt Gardner presented the proposed mission tasks and changes in the design and building specifications. Plans for future Summer Institutes to focus on developing online curriculum and MATE's "SeaMATE" educational ROV project (see MATE annual reports for more information) were also shared.

Jill Zande presented a review of the ITEST grant obligations and a summary of Year 2 accomplishments as well as lessons learned. The regionals that implemented ITEST activities in the first and second years told their "stories," which included their specific implementation approach, successes, and improvements planned for Year 3.

Candiya Mann, the MATE and ITEST project's evaluator, presented her findings from Year 2. She also discussed the plan to streamline the survey process (and expense) by using FedEx Kinko's locations (and the MATE FedEx account) to print the surveys, which can then be picked up by the regional coordinators. That will ensure that the surveys are printed correctly while also lessening the administrative burden on the MATE staff. Regional coordinators can then return the surveys in a FedEx box or envelope (again, charging the cost to the MATE account).

Erica Moulton reviewed the lessons learned from the 2011 Summer Institute and discussed recruitment strategies for the Year 3 Institute. Deidre Sullivan shared information about the new video pilot project.

Farley Shane, a mechanical engineer, hosted the group for a presentation and tour of MBARI in Moss Landing, CA. Farley's presentation included information about the Institute and the research and engineering projects that take place there. The tour included MBARI's underwater robots as well as the chance to step on board the *Western Flyer*, the Institute's small water-plane area twin hull (SWATH) oceanographic research vessel that serves as the support ship for its ROV *Doc Ricketts*. The opportunity to visit this premier scientific research institution not only provided professional development, but was also particularly helpful for regional coordinators outside the U.S. to leverage their home institutions to cover travel expenses. The 2011 meeting agenda and participant list are included within the Addenda.

Advisory Committee
Like last year, the meetings with the project's Curriculum and Cultural Advisory Committee in Year 3 were "virtual." We found it more beneficial and cost effective to call upon specific members for advice and reviews based on their time and expertise, rather than to bring everyone together for a face-to-face meeting.

For example, we worked closely with advisory member DeDee Ludwig, formerly with the Shedd Aquarium and now with San Francisco's Exploratorium, on the middle school curriculum. Members Kim Swan and Jenny De La Hoz from the Monterey Bay Aquarium continued to play key roles in connecting the PI/Monterey regional coordinator with area schools and administrators. Kim also provided guidance on improving both professional development and student workshop offerings. We will continue to work with the advisory committee in this capacity to make the best use of their and our time, resources, and expertise.

DISSEMINATION & BROADER IMPACTS

Dissemination
Between the MATE Center and its regional partners, nearly 50 abstracts, journal papers, newspaper articles, web sites, and television and radio news stories featured ITEST grant activities. These included the following:

- www.youtube.com/watch?v=wyP8XjT62K4&feature=youtu.be from the Great Lakes regional
- http://savannahnow.com/news/2012-02-25/video-electronic-sea-turtles-take-over-ymca-pool#.T-tWzfJdC1c from the Gray's Reef Southeast regional
- www.heraldnews.com/news/education/x780397762/Henry-Lord-students-learn-a-lot-from-aquatic-robots from the New England regional
- CBS News: MAST Students Explore the Deep with Ocean Diving Vehicles: CBS Miami – March 5th, 2012 on Air. from the Florida regional
- Yeager, Kurt. "Highway 68 ROV Club brings home medals." Off 68. Jun. 1, 2012. Pg. 32. from the Monterey regional

Information about MATE's ITEST project was presented at nearly 60 regional and national conferences, meetings, workshops, and/or other events, including the following examples:

- Association for Unmanned Vehicle Systems International (AUVSI) Foundations' Forum on Robotics Education, Washington, DC, August 2011
- MTS/IEEE OES Oceans Conference and Exhibition, Kona, Hawaii, September 2011
- Girls Collaborative STEM Conference, Colorado Springs CO, October 2011
- Global Learning Charter Middle School Women in Engineering, New Bedford, Massachusetts, March 2012
- Florida Marine Science Educators Association Conference, St. Petersburg, FL, May 2012

Given the nature of several of these events (i.e., community-wide gatherings, such as the Biggest Little Airshow held at the Pacific Aviation Museum on Oahu and the Maker Faire held in San Mateo, CA), it's difficult to provide an exact number of the people (including teachers, students,

parents, and the general public) these presentations impacted, but it is definitely in the thousands.

Expanding the U.S.-based Regional Contest Network
Since MATE's ITEST proposal was funded, four new U.S.-based regionals have 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); 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); and the Oregon Regional ROV Contest (organized by Oregon State University/Oregon Sea Grant, the Oregon Coast Aquarium, and the MTS-Oregon section and supported by the PNW regional coordinators). All four regionals represent substantive partnerships amongst regional K-12 and postsecondary (formal and informal) educational institutions and/or workforce investment boards.

While these regional coordinators were not part of the original proposal, they have benefitted from ITEST work, including the new and improved recruitment strategies, professional development lessons learned, and access to the draft curriculum. The Oregon coordinators, in particular, gained from ITEST as the PNW coordinators supported the development of this regional with their Year 3 funds as well as their time and expertise. The MATE Center and ITEST have benefitted in return via the numbers of middle school teachers and students that these regionals have engaged.

Through our regional and MATE partnerships, we have also connected with organizations and individuals who are interested in bringing the ROV competition program to their region. For example, the Dauphin Island Sea Lab currently offers ROV workshops and is on the path to establishing a culminating, contest event for area schools. Our Center for Ocean Sciences Education Excellence (COSEE) colleagues, we became aware of these efforts and are currently in discussions with the coordinators of the DISL program to add that event to the MATE regional contest network.

Foreign Regionals Leveraging ITEST
The Newfoundland and Labrador (NL) regional continues to use the ITEST grant to leverage support for its contest, supporting workshops, and outreach. The Marine Institute of Memorial University of Newfoundland, the lead coordinator of the NL Regional ROV Contest, held its third SCOUT class competition on March 30-31, 2012. Twenty-eight schools participated. The SCOUT class program was again supported by the Government of Newfoundland and Labrador, along with a significant contribution from Exxon Mobil. Participating schools were provided with building materials, professional development for teachers, and travel to the competition. The Marine Institute also received funding directed at operating the competition itself; these funds were used to purchase trophies and awards, lunches, and the awards banquet.

Given the very positive outcomes and growth over the past two years, it is expected that funding for the program will continue next year. The availability of this funding was a critical prerequisite to establishing NL's SCOUT class and was based on the past history of the province's high school ROV program and inspired by an awareness of NSF's support of the MATE Center through the ITEST grant.

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

For

The Marine Advanced Technology Education (MATE) Center

September 2012

Submitted by:

SESRC

Social & Economic Sciences Research Center (SESRC)

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

For

The Marine Advanced Technology Education (MATE) Center

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September 2012

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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.

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EXECUTIVE SUMMARY

Evaluation of Innovative Technology Experiences for Students and Teachers (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

AUGUST 2012

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 July 1st, 2011 and June 30th, 2012, the third year of the grant. The MATE Center has been granted a one-year, no-cost extension to their grant. Year-to-year comparisons of evaluation results will be included in next year's final, summative report. This report describes the project implementation as well as the preliminary findings for each of the research questions. The implementation is discussed by project objective, while the evaluation findings are reviewed by project strategy. This structure mirrors the evaluation design.

Project Implementation

In the third year of the grant, the MATE Center made progress in implementing all four grant objectives.

Objective 1: Build the support infrastructure for an entry-level ROV competition class

In the third year of the grant, the MATE Center completed its roll-out of targeted support for the entry-level (SCOUT) ROV competition class, from eight to twelve regions that cover the country from coast-to-coast: Monterey Bay, Pacific Northwest, New England, Southern California, Florida, Mid Atlantic, Oahu, the Great Lakes, the Big Island, Texas, Southeast, and Midwest.

Teacher and student workshops were offered in all regions. The MATE Center provided additional support for the teachers through its week-long beginner-level Summer Institute, held in Monterey, California, July 8 – 14, 2012.

An important component of the support for the SCOUT class was the middle school, ROV-focused STEM curriculum. In year three, the curriculum was distributed to teachers throughout the ROV competition network and reviewed by content experts.

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

The MATE Center researched and assessed existing career resources for middle and high school audiences. They beta tested the *Exploring Ocean Careers* course with high school students and also ran a pilot video program, where the students created their own technical, career or competition videos.

Objective 3: Build a cyberlearning center

The ROVER website was launched in September 2010. It contains links to a growing selection of external career and instructional resources, acts as a gateway to the MATE Center's other social media efforts and hosts the competition registration system.

Objective 4: Evaluate and track project participants

In the third year of the grant, interview and survey protocols were refined, including translating some into Spanish, and they were administered to a variety of project stakeholders. Analysis of the multiple data sources provided findings on the project's movement towards the expected outcomes. This report demonstrates the progress made towards Objective Four.

Findings

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

Project Strategy 1: Provide Professional Development

- **Increased Confidence Facilitating STEM Learning Experiences:** At the regional workshops, the percentage of teacher respondents who rated themselves as "very comfortable" facilitating STEM learning experiences for students rose from 39% in the pre-workshop surveys (N=82) to 60% in the post- surveys (N=83). After the training, 93% indicated that they felt less concerned about designing and building an ROV.
- **Strengthened Commitment to Participate in the Program:** As a result of the workshops, 83% of the teacher respondents (N=39) stated that they felt more committed to participating in the competition.
- **Increased Awareness/Understanding of Ocean STEM Careers:** In the follow-up survey conducted six months after the week-long Summer Institute, the majority of the respondents indicated that the Institute helped them understand the knowledge and skills needed for marine occupations (83%, N=12) and the current technologies used in the marine field (75%).

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

- **Increased Awareness of STEM Careers:** After building their ROV, 81% of the students surveyed (N=443) indicated that they knew more about careers in marine STEM.
- **Increased Interest in STEM Careers:** Over half of the students (56%, N=443) stated that their ROV project made them more interested in a marine career, and 79% of the teachers (N=90) observed an increase in their students' interest in pursuing a STEM career.
- **Increased Interest in STEM:** Three-quarters of the students (75%, N=443) indicated that their ROV project made them want to learn more about ocean STEM. Ninety-two percent (92%, N=90) of the teachers and 91% of the parents (N=220) observed greater interest among the students in learning STEM.
- **Increased STEM Knowledge & Skills:** The majority of the teachers (98%, N=90) observed improvements in their students' STEM knowledge and skills. Parents (N=220) reported that building an ROV contributed to improving their children's grades in engineering/robotics (59%), science (49%), math (36%) and computers (35%).

- **Increased 21st Century (SCANS) Skills:** Ninety-four percent (94%, N=90) of the teachers observed increases in their students' skills in team building, problem solving, and/or critical thinking. Sixty-eight percent (68%, N=220) of parents reported that their children were better able to work with others; 61% indicated that their child's self confidence improved; and 30% marked that their child was better organized.
- **Increased Parental Support of Their Children's Interest in STEM:** Eighty-one percent (81%, N=220) 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.
- **Overall Rating of MATE Center Support:** After the competition season, 51% of the teachers (N=90) rated the support provided by MATE as excellent, and 32% provided a rating of good, for an overall positive rating of 83%.
- **Overall Opinions of ROV Program:** The ROV program was rated positively (excellent or good) by 89% of the students (N=443), 100% of the teachers (N=90) and 99% of the parents (N=220).

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

Marine STEM career information was disseminated to students and teachers through workshops, the Summer Institute, presentations to schools, and the competition itself. After the competition, 81% of the students (N=443) reported that they knew more about marine STEM careers. After the Summer Institute, 83% of the teachers (N=12) indicated that the Institute helped them better understand the knowledge and skills needed for marine occupations.

Project Strategy 4: Build ROVER, a Cyberlearning Center

- **Increased Access to Career and Instructional Resources:** The website is populated with an extensive and growing selection of links to internal and external resources: 722 at last count.
- **Use of Website and Resources:** There are many indications that the website and resources were used in year three, including the website user registration survey (N=544), Twitter followers (264), Facebook "likes" (535), Flicker photos (3,223 photos), YouTube videos (226 videos) and ROV competition registrations (over 2,500).

Broader Impacts

The MATE Center's ITEST activities have been leveraged in ways that were unanticipated during the writing of the proposal. These "broader impacts" fall into three main categories:

1. Leveraging ITEST activities/funding to raise additional funding by regional coordinators, teachers, schools, and student teams
2. Using ROVs and ROV-based activities outside of the competition by teachers and students
3. Involving college students to mentor middle school ROV teams in several competition regions

Student Findings by Demographics

According to the demographic data in the surveys (N=443), the students were about one-third female (35%), forty-three percent (43%) were of minority backgrounds, 41% came from high poverty areas, and 2% reported that they had disabilities requiring accommodations.

Overall, there were few statistically significant differences by gender, ethnicity, disability status or socioeconomic status, indicating that the ROV program was effective in producing positive results for under-represented students as well as the students who traditionally participate in STEM learning opportunities.

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 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 July 1st, 2011 and June 30th, 2012, the third year of the grant. Year-to-year comparisons will be presented in next year's final, summative report. The results are presented below in two chapters. The first chapter, *Project Implementation,* describes how the ITEST grant has been implemented in the second year. The second chapter, *Findings*, discusses the 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? 1.2. What was the impact of the workshops on the teachers' decision to participate in the ROV competition? 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? 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? 2.3. Were the curriculum materials and workshops at the appropriate level for a middle school audience? 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?

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? 3.2. 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? 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? 4.3. Has ROVER increased communication between students, educators, industry professionals, and parents? 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, judges/volunteers, 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.

ROV Competitions

At the ROV competitions, input was solicited from as many stakeholders as possible, including students, teachers, parents, and judges/volunteers. In the second year of the grant, the competition survey method changed from a mix of online and paper with hand data entry to all paper surveys in a "scannable" format. Data entry was completed by scanning the surveys and entering the written comments by hand. Data analysis was performed with the Statistical Package for the Social Sciences (SPSS). This survey methodology continued in the third year. In year three, the student and parent surveys were translated into Spanish. Student, teacher, and parent surveys were administered at all regional events. Judge surveys were administered at all regional ITEST events except for Florida, New England, and Texas.

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

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 more than 3,000 students over the past five years at regional and international ROV competitions. In year three, the student surveys were translated into Spanish. 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.

TEACHERS

Teachers 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 more than 700 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 and skills, SCANS skills, and interest in STEM careers, and related topics.[2]

PARENTS

In contrast to the student and teacher surveys, which have been conducted for years at MATE ROV competitions, year one of the grant was the first time parent input was solicited. Parents responded enthusiastically and seemed to appreciate the opportunity to provide input. The surveys were implemented again in the second year of the grant. In year three, the survey was translated into Spanish in order to promote even wider participation by family members in the evaluation, especially in regions with large Spanish-speaking populations, such as Florida and Southern California.

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.

[2] In the first year of the grant, a separate web survey was conducted in order to ask the teachers participating in the ITEST grant-funded activities some additional questions. (The post competition surveys are administered to all regional event participants, not only the ITEST program participants.) The web survey had a very low response rate so in the second year of the grant, the web survey was discontinued, and a few additional questions were added to the post-competition survey. The new questions asked the respondents to rate the ROV program and the support they received and to report on the obstacles they faced.

JUDGES

In the second year of the grant, input was solicited for the first time from industry representatives serving as judges at the competitions. The survey was piloted at the international competition. In year three, the regional coordinators were invited to use this survey as well, on an optional basis. This survey collects information on the judges' experience at the competition, whether they feel it was a worthwhile use of their time, the skills of the students they observed, and their opinions on the usefulness of the competition in preparing future employees.

In the prior year of the evaluation, judge surveys were only administered at the international competition. In year three, these surveys were offered at all regional ITEST events, except for Florida, New England, and Texas.

Regional Workshops

PRE AND POST TEACHER WORKSHOP SURVEYS

Pre and post paper surveys were administered to teacher workshop attendees in the Monterey, Florida, Midwest, Big Island, Southeast, and Pacific Northwest 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 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.

Summer Institute

IMMEDIATE FEEDBACK AND SIX-MONTH FOLLOW-UP SURVEYS

The evaluation of the Summer Institutes is a two-step process, collecting feedback from the participants immediately after the Institute (using the Institute feedback surveys) then again a few months later (using the Institute follow-up surveys). The follow-up surveys intend to measure the Institutes' longer-term impact and, in particular, to compare participants' actions once they returned to their classrooms with the intentions they had expressed at the close of the Institute. Because of the timing of the Summer Institute and the evaluation reporting, this evaluation covers the year two Institute. The feedback survey had a response rate of 80% (16 out of 20), and the follow-up survey had a response rate of 60% (12 out of 20).

Curriculum

TEACHER CURRICULUM FEEDBACK SURVEY

In year two, the draft curriculum was distributed to the teachers throughout the competition network, and their opinions about the curriculum were solicited through a feedback form. This survey asked them how they used the curriculum, their level of experience in leading science and technology activities, who they taught with the curriculum, and how they would rate the curriculum overall, the appropriateness of the content for the middle school audience, the guidelines and background materials for teaching the content, if the curriculum uses appropriate strategies to meet the needs of diverse audiences, and if the curriculum is free of bias. In year three, the project focused on updating the curriculum, and no additional evaluation of the curriculum was performed.

Other Data Sources

Additional data sources informing the evaluation include the annual reports turned in by the regional coordinators to the ITEST grant PI, observations of the Pacific Northwest regional competition and the regional coordinators meeting, review of participation data, unsolicited letters sent to the regional coordinators and the MATE Center from students, parents and teachers, website review and document review, including supporting technical materials and the MATE Center's annual report.

Challenges of the Evaluation and Lessons Learned

SURVEY METHODS

Year One

In the first year of the grant, the survey implementation was somewhat uneven, and the data did not cover all of the regions because some of the regional coordinators did not administer them. With the quick project ramp-up, regional coordinators were pulled in many different directions, and occasionally, survey implementation was forgotten.

Year Two

In the second year of the grant, several strategies combined to produce much better data. This effort began with the regional coordinators meeting in September of 2010. This meeting was the kick-off for the second year of the grant. The evaluator shared the results of the first year of evaluation and stressed the importance of the data collection activities. The regional coordinators received a complete set of data collection instruments, along with training on how and when to implement each.

In addition to improving the coordinators' awareness of the data collection expectations, the survey administration method was revised as well. To reduce the burden on the regional coordinators, the post-competition surveys were changed to a format suitable for scanning the resulting data. The surveys were printed at the MATE Center's head office at Monterey Peninsula College and mailed to the regional coordinators with a pre-filled UPS label and box to return the completed surveys to the evaluator for processing.

This method was very effective, and post-competition surveys were returned by all but one ITEST region.[3] This survey method also reduced the data entry burden on the MATE Center's administrative assistant, resulted in a quick turn-around for creating the dataset, and resulted in cleaner, more comprehensive data suitable for more sophisticated analysis.

The downside to this method was the increased costs in printing, shipping, and data entry. Some of the increased costs were one-time expenses, such as transforming the surveys into the format for scanning. Additionally, this method required a significant amount of the MATE Center's administrative assistant's time to coordinate the printing and mailing.

Year Three

Grant year three again kicked off with a regional coordinators meeting, where the evaluation results from year two and the data collection plan for year three were presented. Regional coordinators were very interested in the results, and the presentation resulted in an engaging discussion.

In year three of the grant, survey administration was largely unchanged, with one exception. In order to lessen the administrative burden of coordinating the printing and mailing of the surveys, Kinko's did the printing. The method was as follows:

- In advance of the regional competitions, the regional coordinators identified a local Kinko's convenient to them.
- The MATE Center emailed the survey files and printing instructions to the Kinko's.
- The MATE Center mailed pre-printed FedEx labels to the regional coordinators.
- Kinko's printed the surveys and also provided an empty FedEx box.
- The regional coordinators picked up the surveys, administered them, and returned the completed surveys to WSU via FedEx.

This method worked relatively well, and surveys were again completed by all regions. Coordinating the printing with multiple Kinko's sites took more administrative time than expected, and in the case of the

[3] This survey method was used for the entire MATE competition network. Over 1,800 student surveys and 400 teacher surveys were returned from the entire competition network in the 2012 season, far surpassing the completion numbers from prior implementation methods.

South Carolina region, the surveys were not printed on time, due to a miscommunication. In order to collect data from this region, the student and teacher surveys were programmed online, and the regional coordinator emailed the survey invitations.

The downsides to this approach were 1) cost and 2) administrative time. Next year, the surveys will be printed and mailed by WSU. This approach has the advantage of better quality control, lower cost, and coordination of printing with a single contact. A certain amount of administrative time is unavoidable: this includes tasks such as determining the dates of the regional events and the number of each type of survey in each language (English/Spanish) at each event.

DEMOGRAPHIC DATA

Year One

In year one, student demographic data was collected by asking the regional coordinators to request the data directly from the schools or clubs that sent ROV teams. This method proved to be very cumbersome, sparked privacy concerns among the participating organizations, and resulted in very uneven data of poor quality.

Year Two

In the second year of the grant, the evaluation moved to an approach relying entirely on self-reported demographics using the post-competition surveys. This approach has the advantage of allowing the surveys to be anonymous while still providing the ability to analyze the results by the demographic factors. It has the disadvantage of only measuring the students who made it to the competition.

The first year of the evaluation only included demographic analysis by gender and ethnicity. In the second year, disability status and socio-economic status were added. In general, socio-economic status is a sensitive subject. Schools do not like to share information on students' eligibility for Free and Reduced Price Lunch (FRPL), and asking students how much money their family makes raise privacy issues (assuming the students even knew the answer to the question). In order to avoid triggering concerns from schools and parents, the evaluation used the students' home zip codes as a proxy for socioeconomic status. The zip codes were matched to US Census data on the percentage of families with children under 18 living in poverty. Students living in zip codes with greater than national average for families living in poverty were marked as living in high poverty areas. Unfortunately, the 2010 Census data on poverty was not released yet, thus the 2000 Census data was used for this year's analysis.

In addition, the teacher survey was revised to include more demographic data, and this information was also asked of judges. The goal of these questions is to show the percentage of under-represented role models that the students come into contact with through the program.

Year Three

Year three of the grant continued the year two approach to demographic analysis. Unfortunately, the 2010 Census poverty data was not available at the Zip Code Tabulation Area (ZCTA) at the time of this report so the 2000 Census data was used again. The American Community Survey plans to release poverty data at the ZCTA level in late 2012. Next year's evaluation will rely on this updated data source.

OTHER CHALLENGES

Within the ROV program, the regional coordinators have considerable latitude in how they implement the competition activities. 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 data collection plans in the proposal 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.

Other basic challenges of the evaluation include the fact that the program does not have direct access to the students prior to the competition so true pre-post comparisons are not possible; the program takes place in multiple regions across the country, each which brings different strengths and weaknesses that can affect the results, and the grant activities involve a subset of participants in a larger program, which brings the challenge of identifying the ITEST participants.

PROJECT IMPLEMENTATION

This chapter reviews the progress towards implementing each of the four grant objectives. Each of the 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.

SUPPORT FOR ENTRY-LEVEL ROV COMPETITION CLASS

In the third year of the grant, the MATE Center continued its roll-out of targeted support for the entry-level (SCOUT) ROV competition class. In the first year, four regions participated in the grant: Monterey Bay, Pacific Northwest, New England and Southern California. In the second year, these four regions continued their SCOUT support activities, and four more regions began their SCOUT support efforts: Florida, Mid Atlantic, Oahu and Great Lakes. In the third year, the eight prior regions continued, and four additional regions began their grant activities: Monterey Bay, Pacific Northwest, New England, Southern California, Florida, Mid Atlantic, Oahu, the Great Lakes, the Big Island, Texas, Southeast, and Midwest.

Through the 388 student workshops, classroom visits, and outreach activities, in year three, over 3,300 students were involved with the program. The support for the SCOUT class included 48 regional professional development workshops and one Summer Institute. Each of these will be described in turn below.

Regional Workshops for Teachers and/or Students

Regional coordinators have the flexibility to specialize the workshops in their region to the particular needs of their audience. That said, the workshops tend to cover a core, basic set of knowledge and skills. Generally, the competition season begins with a workshop for the new teachers only. This workshop allows the teachers to build their own ROV that they take with them to use as a teaching tool. They go back to their classes/clubs and assemble a team of students. Their students are welcome to come to the rest of the workshops. Indeed, some students come on their own, without their teacher/mentor. The follow-on workshops tend to cover subjects such as wiring and waterproofing. The regional coordinators also help to arrange for pool practice time. While these sessions are not “workshops” per se, they are valuable learning experiences and the coordinators are generally on-hand to offer one-on-one troubleshooting.

Summer Institute

Since the Summer Institute takes place shortly after the evaluation reporting period closes, each evaluation report covers the institute from the prior grant year. The year two ITEST Summer Institute took place July 8 – 14, 2012. The goal of the Institute is 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 Institute.

Three-quarters (75%) of Institute participants taught in middle schools or junior high schools, and most of them taught science (56%), in addition to another subject (56%). The other subjects included robotics, underwater archeology, maritime history, literature of the sea, and science enrichment activities for the entire school. Participants came with a wide range of teaching experience, from one year to 28 years. The participants report that they teach an unduplicated count of just over 1,500 students per year.

Figure 1: Grades/Levels Taught by Institute Participants

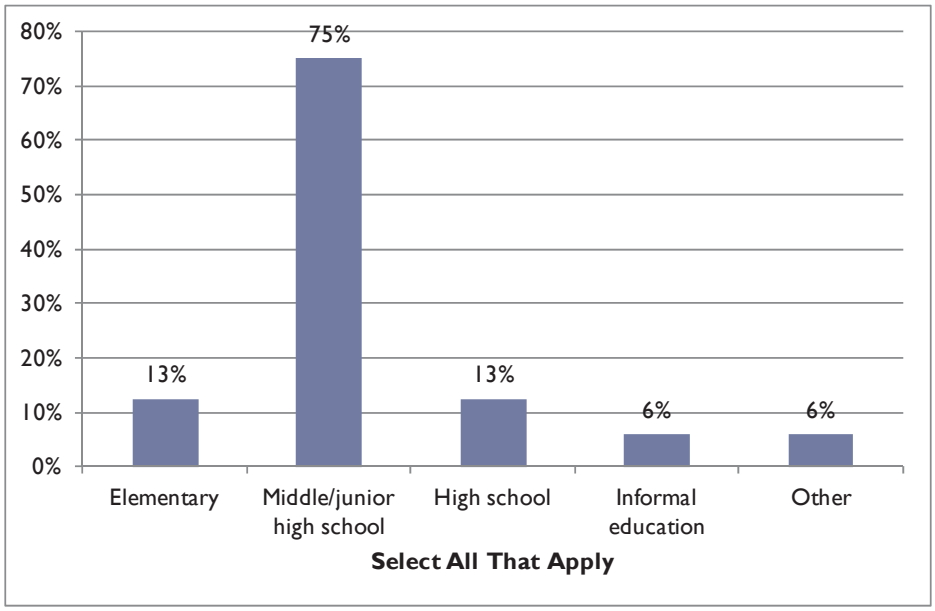
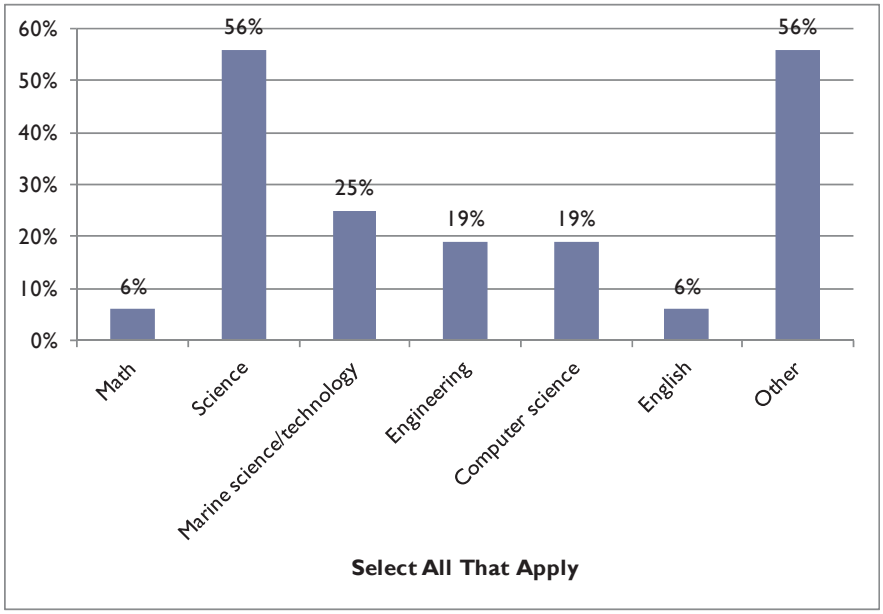


Figure 2: Subjects Taught by Institute Participants



ROVER MIDDLE SCHOOL CURRICULUM

In the first two years of the grant, the Shedd Aquarium collaborated with the MATE Center to draft the ROVER middle school STEM curriculum. This ROV-focused curriculum is a collection of chapters that can be implemented as stand-alone activities/modules or as a full course. An in-depth review of the curriculum was conducted by an elementary/middle school science program coordinator and a retired middle school science teacher. After their feedback was incorporated into the curriculum, a beta version was distributed by the regional coordinators to the teachers attending workshops throughout the ROV competition network.

In year three, the Center continued to work with the (now former) Shedd Aquarium education specialist to refine the draft middle school ROV curriculum. This curriculum was disseminated to the year one and two ITEST teachers. It has also been reviewed by content experts, including the Director of Programs of Immersion Presents (see www.immersionlearning.org). Immersion Presents also contributed content and images. The Center also received permission from the Mechanical Engineering Department at Villanova University to use lessons from their underwater robotics curriculum (see www72.homepage.villanova.edu/aaron.wemhoff/URC/Underwater%20Robotics%20Curriculum.pdf). This information, along with photos and illustrations from MATE's underwater robotics textbook, are currently being incorporated. The goal is to finalize the curriculum and disseminate it to ITEST teachers, project partners, and via the ROVER web site during the one-year, no-cost extension of the grant.

OBJECTIVE TWO

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

Originally, the MATE Center planned to achieve Project Strategy Three, modifying career guidance resources to better suit middle and high school students, through updating the *Exploring Ocean Careers* course and website. As the preparatory research for this update was completed, it became clear that a different approach would be more effective to providing career guidance resources for these two audiences, as discussed below.

High School Students: The *Exploring Ocean Careers* course is set up so that all students complete the first few chapters, which help them assess their skills and which careers might be the best for them. Next, they read (or listen to) only the chapters that apply to their target careers. The MATE Center has begun beta testing this course with high school students, to very positive reviews.

It appears that for the high school audience, modification of the online course is not necessary; however, the MATE Center would like to increase access to the course. Thus, in the fall of 2012, the course will be migrated from Moodle, which limits access to users with this particular software, to the MATE website. The entire course will be open to the public, with the exception of the quiz banks, which will be shared with teachers who deliver the course for academic credit.

Middle School Students: When considering how best to modify the *Exploring Ocean Careers* course, the MATE Center began by interviewing middle school teachers. The teachers posited that career videos would be the most effective way to reach this audience, since videos require a shorter attention span and provide action and excitement.

The MATE Center researched existing marine career videos and rated them. Overall, they found that a wide variety of high quality videos were already available from sources such as ATE TV and ABC TV. However, they also discovered that these resources were not widely known among middle and high school teachers. To facilitate access to these videos, they plan to link them to the revised MATE Center website.

Pilot Video Program: In grant year three, the MATE Center piloted a program that encouraged ROV competition student participants to create their own videos. Six teams in the southern California region were selected to participate in the pilot: three Ranger teams and three Scout teams. In January 2012, the teams participated in a workshop with a professional videographer. A total of eight mentors and 23 students attended. Each team was provided with a waterproof video camera to use for the duration of the project. They received training in the use of the camera, as well as storyboarding, filming, editing with iMovie, and distribution. They were encouraged to create videos of no more than two minutes that focused on an experience participating in the competition, a technical lesson, or a marine STEM career.

They could use a reality show approach, a news report approach with interviews, or they could make tutorials, music videos, stop motion animation, or follow their own inspiration.

After the workshop, the teams were supported through the videographer calling and emailing the team mentors. She checked on their progress and offered technical support. She offered underwater shipwreck (the theme of the 2012 competition) footage to be incorporated into the students' videos. She also set up a Wikispace where the workshop videos and information were posted. Additionally, pages were set up for team communication and sharing information.

By the international ROV competition in June 2012, two of the six teams posted videos. Several valuable lessons were learned as a result of the pilot project:

- There was no deadline so several of the teams are still working on their videos. Next year, the Center will consider setting a deadline.
- The main challenge for the teams was finding the time to do the editing, with the many competing academic and extracurricular demands. Next year, the Center will consider creating a contest (possibly combined with the ROV competition) and offering a prize.
- The Wikispace was not used by the teams. In fact, most teams did not register for access. Next year, the Center will try to hold the kick-off workshop at a site with internet access so the teams can register during the event. Alternately, other communication methods/venues will be explored.

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.

The ROVER (ROV Education and Resources) website was launched in September 2010. It contains links to a growing selection of external career and instructional resources, acts as a gateway to the MATE Center's other social media efforts and hosts the competition registration system. In year three, ROVER continued to serve as a portal for information, resources, communication forums, links to outside sources, social media outlets, and more. It served as the one-stop shop for competition information, communication, and participant support again this year. From mid-June 2011 until present, the site has received 43,242 unique visitors. The majority of visitors (69% of those completing a first-time user survey) were students. The main resource visitors were seeking was ROV competition information (93%), followed by technical resources for building ROVs (36%).

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 third year of the grant, interview and survey methods from the second year were refined, and survey protocols were translated into Spanish. Records review and observations of meetings and competitions also informed the evaluation. Analysis of the multiple data sources provided 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 Monterey on November 10-11, 2011. This meeting allowed the regional coordinators who participated in the first two years of the grant implementation to share their experiences and lessons learned.

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.

FINDINGS

This chapter reviews the project strategies and associated research questions. Evaluation results from all applicable data sources are summarized under each research question. A discussion of results by gender, ethnicity, socioeconomic status and disability status is included at the end of the chapter.

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

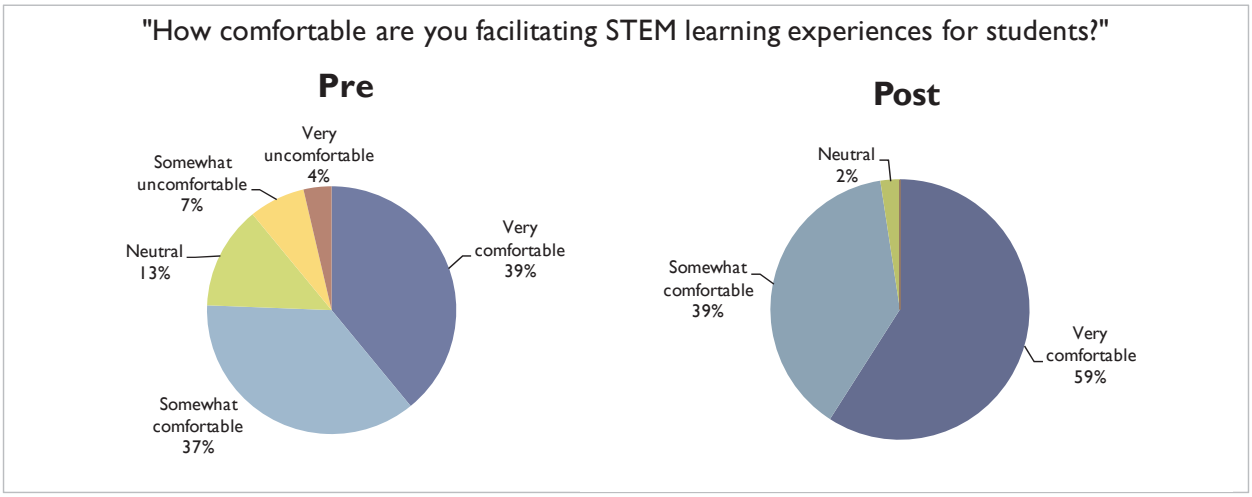
Research Question 1.1. Did the teachers gain confidence facilitating STEM learning experiences through the workshops?

Pre and post workshop surveys, post competition surveys, and Summer Institute feedback surveys demonstrate that the participants gained confidence facilitating STEM learning experiences through the training and support provided by MATE.

The pre-workshop surveys show that there is a need for the workshops. Before the training, well over one-third of the respondents (42%, N=82) stated that they had concerns about mentoring students in designing and building an ROV. Over half of the teachers (55%) indicated that they were concerned that they might not have the necessary technical skills and expertise.

The percentage of respondents who rated themselves as “very comfortable” facilitating STEM learning experiences for students rose from 39% in the pre-workshop surveys to 60% (N=83) in the post-workshop surveys.

Figure 3: Level of Teacher Confidence Facilitating STEM Learning Experiences: Pre and Post Workshops



When asked if the training addressed their concerns about designing and building an ROV, 93% indicated that they felt less concerned. Overall, 88% of the respondents rated the usefulness of the training as "excellent", and 11% gave it a rating of "good". One individual rated the training as "fair". Open-ended comments included the following:

> *This training really helped alleviate many of my concerns about so many things. It was good to talk to you guys (the experts) and other teachers ranging from experience to multi-year veterans.*

After the competition season, teachers rated the support provided by MATE. Half of the teachers (50%, N=89) gave a rating of excellent, and 32% rated it as good. Fifteen percent (15%) indicated that the support was fair, and 3% marked that the support was poor. No respondents indicated that it was very poor.

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, 88% of the respondents marked that they intended to mentor a team. (The other 12% marked "maybe"). The majority of the respondents (83%) indicated that as a result of the training, they felt more committed to participating in the competition.

Results from the Summer Institute follow-up surveys indicate that the Institute was also effective at motivating teachers to participate in the competition. In the six-month follow-up surveys, participants indicated described the support provided by MATE in the following words:

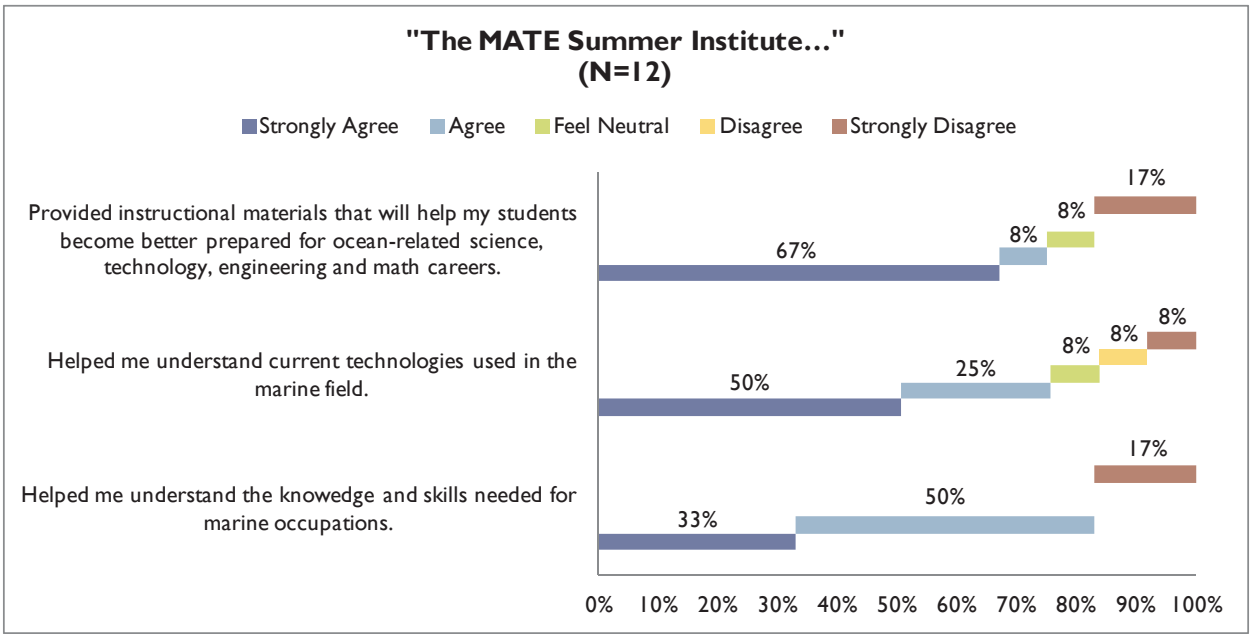
> *I never would have considered a ranger team without the support at the workshop*
>
> *It has helped me take the lead on ROV related education for my institution.*
>
> *I have tried to get some of the other small schools in Cochise Co. involved and to have our own competition. So far I have three schools that are interested in a competition this spring.*

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

In the follow-up survey conducted six months after the Summer Institute, the majority of respondents (83%, N=12) indicated that the Institute helped them understand the knowledge and skills needed for marine occupations and the current technologies used in the marine field (75%). Three-quarters (75%) of the respondents agreed that the Institute provided instructional materials that will help their students become better prepared for ocean-related science, technology, engineering and math careers. Open-ended comments from the Institute participants include the following:

> *Yes, it has given me the opportunity to show my students that there are other fields of employment that can be fun, interesting and can be very challenging.*
>
> *It [having attended the Summer Institute] has doubled my after school science club. More interest in science in general and new occupations.*

Figure 4: 2011 Summer Institute: Affect on Ocean STEM Career Awareness, Percentage of Respondents Agreeing or Disagreeing with Statements



Survey results demonstrate that in the months following the Institute, most of the respondents (92%) implemented what they learned by modifying their courses and teaching strategies (100%). The information gained at the Institute was disseminated by the participants sharing what they learned with their students (100%) and other instructors (100%).

Overall, the Institute received very positive marks, with all of the respondents rating the usefulness of the Institute positively: excellent (83%) or good (17%). Participant comments include the following:

> *The workshop was phenomenal. I look forward to going back for the next level of instruction. The information provided in the workshop helps me to enhance my students learning experiences.*
>
> *I really felt the MATE summer institute was one of the best professional development opportunities I've experienced.*
>
> *Great workshop which I highly recommend to other instructors.*

Project Strategy 2: Support the Development of the SCOUT (Entry Level) ROV Class[4]

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, 81% of the students (N=443) indicated that they knew more about careers in marine science, technology, and engineering. Indeed, almost one-quarter (24%) marked that they knew "a lot more". Over half (56%) stated that their ROV project made them more interested in a marine career. Overall, 43% of the students were interested in having a career in marine science, technology, or engineering; 46% were not sure, and 11% were not interested in a career in this field. Students mentioned wanting careers such as marine scientist, computer programmer, electrical engineer, and mechanical engineer. Students noted that their experience in the ROV program sparked their interest in having a STEM career, with comments such as the following:

> *I am so thankful for the MATE ROV contest. I would have never thought of engineering for a pathway in the future.*
>
> *Before this program I didn't know what to do with my life, but now I do.*
>
> *I thought this was a very fun activity and it taught me a lot about what some people do in life. It also made me consider having a career on robotics.*

Among the teachers/mentors who completed post-competition surveys (N=90), over three-quarters of the respondents (79%) indicated that they had observed that their students were more interested in pursuing a STEM career. Ninety-four percent (94%) agreed that the ROV program provided a valuable venue to help prepare their students for a career in marine science and technology.

[4] 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."

Parents also noted an increased interest in STEM careers, in comments such as the following:

> *Interest change from medicine to medical robotics - serious, active interest.*
>
> *Career development and interests ID'ed.*
>
> *Interested in career in science.*
>
> *More interested in school and how it relates to the future.*

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 engineering (60%), science (52%), computer science (42%), math (35%), and other hands-on classes or club activities like robotics, electronics and shop courses (62%). Additionally, 53% of the students wanted to learn more about WWII shipwrecks, including how ROV's can be used to assess them. As one student explained his experience, "From doing ROV I've been really interested in other forms of robotics and engineering." Another stated that the competition affected his academic interests as follows:

> *I never participated in these sorts of activities before. Now I have more knowledge, and I am more interested in how marine technology works and, of course, science.*

In the post-competition survey, 92% of the teachers/mentors (N=90) indicated that their students were more interested in learning about science, technology, engineering and math. This follows patterns of prior surveys of teachers/mentors.

ROV Program Testimonials

Students

Don't stop this program EVER! I cannot put into words how much I love this competition. For the two years I have participated, I have learned more about constructing circuits and building than I have through any class or extracurricular.

This was one of the best learning experiences I've had. Not only did I learn how to manage an ROV, I became more aware of fields opening in science and engineering.

I have learned so much about robotics and the value of teamwork and friendship. It is in unforgettable experience that I will treasure always.

I'm looking forward to doing this again. It's fun, exciting, and educational.

Parents

It was like a booster shot of wanting to learn. Best learning experience we've ever encountered.

My daughter had no interest in robotics, but now she loves it! I am so happy with what she has learned, can't wait for her to do this again.

Massive increase in a hunger for knowledge, looking up and researching information.

Faculty/Mentors

This has definitely been an enriching educational experience for my students. They are excited and looking forward to ROV competition next year and are already discussing designs.

Parents concurred with the other sources reporting increased student interest in STEM. Ninety-one percent (91%) of the parents surveyed (N=220) stated that building an ROV has made their child more interested in science, technology, engineering or math. Parents wrote comments such as the following:

> *I have seen just his excitement in all parts of engineering just soar, plus his creativity and understanding of how engineering affects our lives.*
>
> *Developing a strong interest in electrical components*
>
> *Greater interest in (Applied) Science*

Increased STEM Knowledge and Skills: Most students entered with no knowledge about ROV's. Over half of the students (54%) did not know what an ROV was before entering this program, and for three-quarters of the students (75%), this was their first time building an ROV. One indication of increased STEM knowledge is that before beginning their research for the competition, only 12% of the students indicated that they knew "a lot" about WWII shipwrecks. After completing their research, 37% marked that they knew "a lot". Students also gained research skills as part of the competition. Over half (57%) used the Internet to conduct research, including websites for organizations including UNESCO, NOAA, and National Geographic. Additionally, 57% interviewed teachers or parents, and 19% used print resources, such as journals and newspapers. Twelve percent (12%) interviewed working professionals. In the responses to open-ended survey questions, students drew the connection between their ROV experiences and their STEM classes, such as the following:

> *Middle School ROV has opened doors to learning more about marine science. During my science class I used my knowledge from ROV to answer my teacher's questions.*

Among the teachers/mentors who completed post-competition surveys (N=90), 98% of the respondents reported that they observed improvements in their students' STEM knowledge and skills. Parents reported that building an ROV contributed to improving their child's grades in engineering/robotics (59%), science (49%), math (36%) and computers (35%).[5]

Increased 21st Century (SCANS) Skills: In the post-competition surveys, 94% of the teachers/mentors mentioned that they observed increases in their students' skills in team building, problem solving, and/or critical thinking. Teachers/mentors saw skill development in many areas, as evidenced by their written comments:

> *We really enjoyed our experience. Through this program, my students have developed great problem-solving skills and a zeal for STEM competitions.*

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

When parents were asked what changes they have seen in their child as a result of their involvement in the ROV project, 68% reported that their children were better able to work with others; 61% indicated that their child's self confidence had improved, and 30% marked that their child was better organized. In the open-ended comments, parents noted other changes that they observed in their children:

> *Better communication skills; better advocacy skills; takes more initiative; very excited about science.*
>
> *Better able to deal with frustrations*
>
> *Better problem solving skills*
>
> *Commitment and follow through on projects*
>
> *Improved self confidence in area of STEM.*
>
> *More creative in problem solving*
>
> *Overcoming obstacles / perseverance*
>
> *Recognized the need for time management!*
>
> *Responsibility and communication skills improved.*
>
> *He is learning to be resourceful and creative. He also has learned the importance of teamwork and how the ability to work with others is an essential part of a business' success.*
>
> *His biggest challenge is teamwork and following directions, and this project has been really helpful in these areas.*
>
> *Besides the technical aspects of constructing and operating the ROV, they learned about teamwork and the completion of a major project.*
>
> *It has taught him to be a team player, work well with others and be responsible as he feels he needs to contribute and do his best for the group.*

In responses to open-ended survey questions, students also described gaining 21st Century skills through their experiences building an ROV, such as the following: "Great experience to learn about engineering, trial and error, speaking, group work, community outreach."

Overall Opinions of ROV Program:

Overall, parents rated their children's experience building and competing with an ROV extremely positively. Eighty percent (80%) rated it as excellent, 19% gave a rating of good, and 1% marked fair. When asked how valuable the competition has been for the educational development of their child, over two-thirds indicated that it was extremely valuable (71%), one-quarter stated that it was quite valuable (26%), and 3% rated it as somewhat valuable. No respondents marked that it was not at all valuable.

> *Thank you for having this competition. My daughter has learned that Math and Science are very cool. This is something very good for girls her age to learn!*
>
> *I'm excited about the science, technology, and math skills that have been acquired. Equally important, skills have been developed in working with others to accomplish tasks.*
>
> *My daughter is very excited about this competition and super proud of her team's ROV. She is very shy, but her confidence has really been boosted by this process. It was also a great group/teamwork experience for her. ABSOLUTELY GREAT EXPERIENCE for her in so many ways!*

Teachers/mentors gave uniformly positive ratings of the usefulness of the competition, with 80% stating that it was excellent and 20% indicating that it was good. Teachers/mentors also rated the support provided by the MATE program highly (51% excellent, 32% good, 15% fair, and 3% poor). As one teacher stated, "My students and myself loved the program, particularly the integration of STEM, the environmental theme and history (Diving into History)."

Students also rated their experiences building and competing with their ROV very positively, with close to half rating their experience as excellent (47%), and 42% providing a rating of good. Ten percent (10%) thought their experience was fair, and less than 1% gave the experience a poor rating. In the post-competition surveys, students wrote comments such as the following:

> *ROV is one of the best things I have ever done. It has helped me in so many different ways. I also learned a lot of new things. I have made so many new friends who are like family to me now as well. ROV has helped me in school too. I now know things that I didn't know before so I know I can put that information into my school work. Even though I am a while away from deciding what I want to be when I grow up, ROV has changed what I wanted to do at first completely. It has made me so much happier and smarter. I also get to help out the environment. I am just so thankful that I had the opportunity to do something as wonderful as ROV.*

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 (81%) 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. Seven percent (7%) marked that the program participation did not affect how they picture their child's future, and 11% were not sure. Eighty-six percent (86%) of the parents stated that they feel they have at least some influence on their child's career choice.

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

Curriculum materials: Overall, feedback about the curriculum has been extremely positive, with reviewers indicating that the curriculum materials are at the appropriate level for a 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. In the post-competition surveys, half of the teachers (49%, N=90) indicated that having the technical skills and expertise was an obstacle for them. This was especially true of the female instructors, who were over twice as likely to mark this as an obstacle (female: 67%, male: 28%), a statistically significant difference.

The regional coordinators responded to this challenge with different approaches: most offered multiple workshops throughout the program duration. Another professional development opportunity for these teachers is the MATE Center's week-long Summer Institute. One Institute participant noted below that the materials provided at the Institute helped inspire a successful middle school outreach effort:

> *I am using experiments and techniques provided by MATE that I learned about at the Institute. The Institute also inspired me to come up with an event-based ROV-in-a-Bag program this fall at my site that was extremely successful for reaching a middle school population of students and teachers in my community.*

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, 84% of the teachers at the workshops 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 the program.

It appears that the workshops were an important component in supporting the teachers. In the post-competition surveys, teachers who attended workshops were significantly more likely to rate the overall support provided by the ROV program as excellent or good (90%), compared to those who did not attend a workshop (70%).

> *This is a high quality program with a great deal of support. My students learned a tremendous amount and were always enthusiastic and excited about all aspects of the program.*

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

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

As noted above in the implementation section, the MATE Center has decided to take a different approach to enhancing the career information available to middle school and high school students. They have assessed and rated the available career videos and ran a pilot project for students to create their own videos. Next year, they will link the existing career videos to the ROVER website, transition the *Exploring Ocean Careers* course to the ROVER website to be publicly available, and expand the student video project.

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?

As noted above and in the implementation section, the MATE Center's approach to increasing ocean STEM career awareness changed from the initial focus on creating "career guidance tools". Instead, career information was disseminated through the Summer Institute, presentations conducted within schools and regional workshops, and the competition itself, as the students conducted research on the competition theme. See research question 1.3 above for the teachers' increased awareness of ocean STEM careers and section 2.1 for the students' increased awareness.

Project Strategy 4: Build ROVER, a Cyberlearning Center

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

Increased Access to Career and Instructional Resources

One of the goals of the ROVER website is to be a portal for existing career and instructional resources in this field. Towards this end, the website has been populated with the following links. Many of these links lead to collections of resources, so the actual numbers of resources that can be accessed through the links is much greater than the number of links.

Links to MATE Resources:

- 5 ROV Competition FAQs
- 3 Help Videos

Links to External Resources

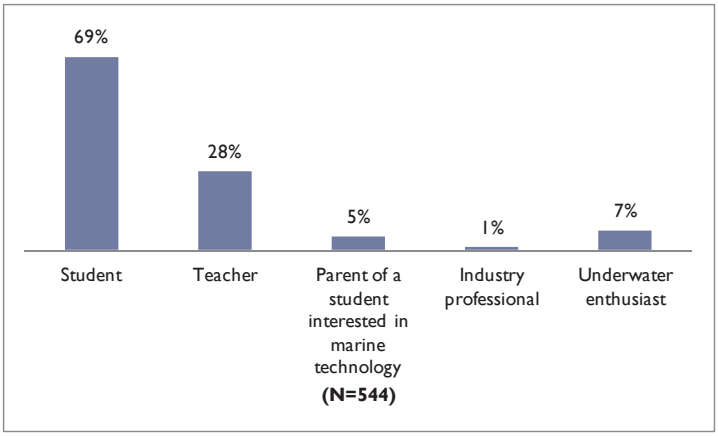
- 434 ROV Videos
- 10 ROV Images
- 9 ROV News Sources
- 31 ROV How-to Books, Information and Articles
- 6 ROV Blogs
- 4 ROV Online Communities
- 59 ROV Building Supplies/Suppliers
- 16 Archived ROV Competition Information Links
- 9 ROV Internships, Scholarships, & Opportunities
- 40 ROV General Links
- 22 ROV Competition Press Coverage Links
- 11 ROV Team/School Links
- 63 Glossary Entries

Increased Use of Website and Resources

Unfortunately, the Google Analytics system that should have been monitoring the website usage was not working, and this failure was not discovered until the end of the international competition in June of 2011. Since that time, the site has received 43,242 unduplicated visitors.

Additional sources of data that indicate usage of the website and other MATE online resources include the following: website user registration survey, Twitter followers, Facebook "likes", Flicker photo views, and YouTube videos. Additionally, the ROV competition registration was handled entirely through the ROVER website, which was an effective way to drive traffic to the site.

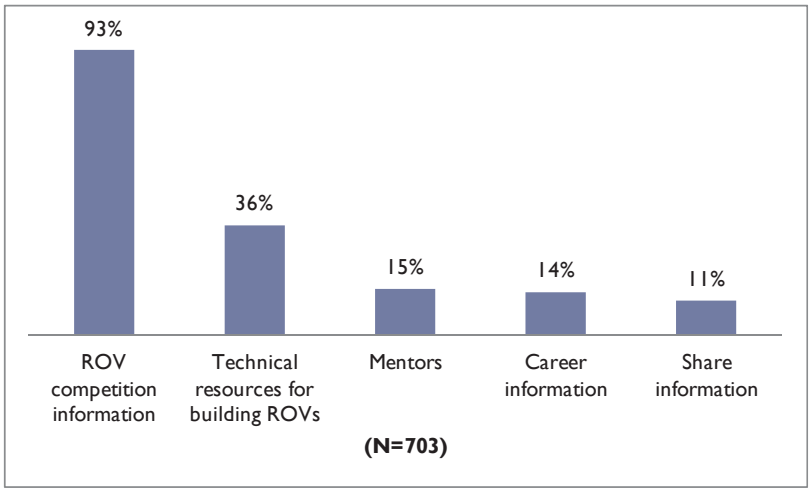
Figure 5: ROVER Website Users, July 1, 2011 – August 27, 2012



When visitors viewed the website for the first time, they were invited to complete a short registration survey that asked about what type of stakeholder they were (student, parent, teacher, industry professional or underwater enthusiast), how they've been involved with the MATE Center, and their reason for registering with the site. The survey was completed by 544 users between July 1, 2011, and August 27, 2012.

By far, the main resource that website users were seeking when they first visited the site was ROV competition information (93%), followed by technical resources for building ROVs.

Figure 6: ROVER Website, Reasons for Registering, July 1, 2011 – August 27, 2012



Beyond the website registration survey, other sources of usage data include the following:

- Twitter: 264 followers, up from 101 last year (http://twitter.com/#!/matecenter)
- Facebook: 535 "likes", up from 134 last year (http://www.facebook.com/pages/MATE-Center/226625134802)
- Flickr: 3,223 pictures of ROVs and participants, up from 1,850 last year (http://www.flickr.com/photos/matecenter)
- Youtube channel: 226 videos, compared to 123 last year (http://www.youtube.com/MATECenter)
    - Total upload views (since May 2007): 41,556
    - Subscribers: 98, up from 54 last year
- 2012 ROV Competition Registration: more than 2,500 student, teacher and judge registrants
- 2012 International ROV Competition Live Feed: During the international competition, a live video feed was streamed on the website. According to Google Analytics, there were nearly 10,000 visits during the event dates.

Plans for the upcoming year include migrating ROVER to the new MATE website platform. Clear Science, Inc., MATE's web developer for the past 14 years and the company that developed and maintained ROVER, moved on from the web development business last fall. After contacting several web development companies, the Center found Byte Technologies, which is in the process of redesigning, restructuring, and populating the www.marinetech.org site. ROVER will migrate next, completing the transition in time for the November release of the 2013 competition information.

Following the transition, ROVER will continue to add content and features. The proposed "Mentor Hotline," a geo-referenced directory of working professionals and the "services" (design reviews, tours of facilities) that they offer, will morph into several different ROVER features. The first will link to the "experts' directory" of the Marine Technology Society, where students can search and directly contact industry professionals with the expertise they are seeking. The second will highlight the student-produced videos described in Objective 2 above, while the third will point students to the Ocean Careers web site and its career profiles. In addition, the Center will create a new "SHARE" area, where students, teachers, mentors, parents, and industry professionals can share their stories, videos, best practices, techniques, curriculum materials, etc. with the larger ROV STEM community.

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?

MATE staff report that the website rollout went smoothly and only a few user issues were reported. Some school computer networks had firewall issues with the site, and some bugs were reported early on within the registration process. These issues were quickly corrected. In the next grant year, user satisfaction will be assessed through adding website usability questions to the post-competition surveys.

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

The website has several different components that are intended to increase communication between students, educators, industry professionals and parents, including several discussion boards. In addition, there are several other methods for these stakeholders to communicate, such as posting photos to the MATE Flickr stream, videos to the YouTube channel or comments on the Facebook page.

The most well-used discussion board on the ROVER website is the ROV competition FAQ page. In the 2012 competition season, there were 450 posts on 150 different topics, a marked increase from the 191 posts in the prior year. PIs attribute much of the increase to their increased attention to "seeding" the discussions. The rule of thumb for discussion board usage is that there are 10 "lurkers" (users reading the posts) for every one user who posts a question or comment.[6]

[6] See "Participation Inequality: Encouraging More Users to Contribute" at http://www.useit.com/alertbox/participation_inequality.html

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

The ROVER website supported teams' ability to build an ROV and participate in the competitions through the online registration system, FAQ discussion board, and links to instructional materials (see above "Increased Access to Career and Instructional Resources").

Broader Impacts

The MATE Center's ITEST activities have been leveraged by regional coordinators and participants in ways that were unanticipated during the writing of the proposal. Thus, they don't fit under any particular evaluation question. Since the evaluation was not set up to monitor these activities, the findings presented here should be considered preliminary. Next year, the evaluation tools will be modified to capture more of this data.

These "broader impacts" fall into three main categories:

1. Leveraging ITEST activities/funding to raise additional funding by regional coordinators, teachers, schools, and student teams
2. Using ROVs and ROV-based activities outside of the competition by teachers and students
3. Involving college students to mentor middle school ROV teams in several competition regions

Leveraging ITEST Activities/Funding

Faculty who led ROV teams and/or attended the Summer Institute reported that they have applied for and won funding from grants and school boards and have received equipment donations from local industry. Examples include the following:

> *Yes, I just was awarded a $1000 grant from PSEF (Peninsula Schools Education Foundation). I also get funds from our ASB to support the club and pay for pool rental and/or transportation +/- $500 to 750. I am hoping to have additional sponsors as well.*
>
> *Just received a grant with Carol Rivera, of a $1000 to support our building of Ranger teams at each of our schools and to try in increase the number of girls in our ROV programs.*
>
> *Great Lakes Stewardship Initiative (GLSI) grant 1500, Friends of Thunder Bay National Marine Sanctuary grant – 1500*
>
> *Our School's Foundation provides me with an annual $1,500.00 grant.*

Additionally, ROV competition regions outside of the United States have leveraged news of the ITEST grant raise additional funds.

Using ROVs outside the Competition

Many faculty have reported using ROVs or ROV-based activities outside of the competition, incorporating these tools and topics into their classes or clubs in order to bring science to life. Examples from year 2 of the grant include the following:

> *The ITEST funded project helped us leverage this film project with the Great Lakes Stewardship Initiative. In the end, the students talk about both preparing for the MATE competition and using ROVs to study zebra mussels/shipwrecks. http://vimeo.com/25825942, password: syrup*

> *My marine science class built ROV's and have acquired an underwater video camera which we have attached to a ROV to monitor marine life in our area.*

> *My kids had a blast! They are planning on building an ROV this summer to take down the river with them!*

> *I am using my ROV group to promote this new science area for our local 4-H program. We are planning demonstrations at 4 different events in the spring and summer.*

> *I am once a week exploring a field of marine science with the students and companies and government agencies that rely on this skill and education.*

> *It [the Summer Institute] opened my experiences I could share with my students - we followed SCINI when it went to the Arctic and even took data from the Arctic to graph in the classroom. Having the students view my pictures from MBARI and seeing their teacher there and then SCINI on the news - brought home the relevance.*

College Students as Middle School ROV Team Mentors

In several regions, the regional coordinator matched up college students – in many cases, former ROV competitors themselves – with middle school ROV teams to work with them throughout the competition season. College students also acted as helpers at the workshops. In some cases, the college students received a small stipend (though they stated that they would have done the work without it), and in other cases, they received service learning credit, Presidential Volunteer Service Awards, or simply volunteered their time with no recompense. This arrangement worked well for the regional coordinators, college students and middle school students and teachers.

Involving college students as mentors helped the regional coordinator ensure that the middle school teams had the one-on-one support that many of them needed. Since over half of the teachers at the workshops (56%) were concerned about having the technical skills and expertise, the additional technical support was a boon for many of them.

Anecdotal reports suggest that the involvement of college students as mentors can lead to profound experiences for both the college and middle school students. Many sources reported that the middle school students found the college students to be approachable representatives of science. These young adults modeled the paths that the middle school students could take to a STEM career. One service learning college student in grant year three described his conversations with his team as follows:

> *I had a wonderful experience and it's something I will not forget! I can tell that this program makes a difference with the students because they are actually excited to be applying what they are learning in the classrooms.*

The college students indicated that acting as a mentor was a valuable experience for them because it helped improve their science communication, deepened their own knowledge, and acted as a valuable resume builder. Their descriptions of their experiences were filled with adjectives like "exciting", "ecstatic", "amazed".

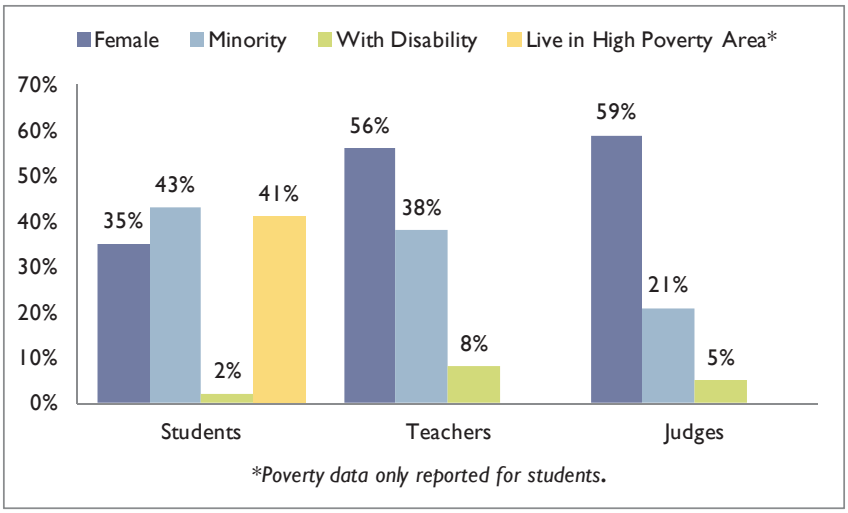
Breakdowns by Demographics

Background: Demographics of Students, Teachers and Industry Representatives

According to the demographic data in the year three surveys (N=443), the students were about one-third female (35%), forty-three percent (43%) were of minority backgrounds [7], 41% came from high poverty areas[8], and 2% reported that they had disabilities requiring accommodations.

The project has made efforts to include the participation of

Figure 7: Student, Teacher and Judge Demographics



[7] 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.

[8] High poverty areas were defined as zip codes where the percentage of families with children under age 18 in poverty was higher than the nationwide average of 13.6%. This calculation is based on data from 1999 reported in 2000, the most recent data available at the Zip Code Tabulation Area (ZCTA) level. The American Community Survey plans to release ZTCA level estimates in late 2012, based on the 2007-2011 5-year estimates.

teachers, college students, staff, and competition judges (industry professionals) of diverse backgrounds who can serve as role models for the middle school students. Over half (56%) of the teachers working with ITEST teams were female, 38% were of minority backgrounds, and 8% indicated that they had a disability.[9]

Among the judges completing surveys (N=96), 59% were female, 21% were of minority ethnic backgrounds, and 5% marked that they had a disability.[10]

Analysis of Student Demographics

In the grant year one report, preliminary results presented the trends by gender and ethnicity only. In grant year two, the analysis took a different approach. Rather than simply look at trends, the changes in survey administration methods helped us produce a dataset more suitable for more sophisticated analysis. Thus, we looked for statistically significant differences between the under-represented students and the students who more typically participate in these types of STEM events.

This new analysis begged the question: how should success be defined? In consultation with project managers, the evaluators decided that the measure of successfully engaging under-representative students would be that their results were not statistically different from the other students' results. In other words, the under-represented students made the same gains as the other students.

Findings by Student Demographics

Overall, there were few statistically significant differences by gender, ethnicity, disability or socioeconomic status, indicating that the ROV program is effective in producing positive results for under-represented students as well as the students who traditionally participate in STEM learning opportunities.

The analysis focuses on whether there were statistically significant differences between the groups in the following topics:

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

[9] The teacher survey did not ask about socioeconomic status.
[10] The judges' survey did not ask about socioeconomic status.

Awareness of STEM Careers

Students were asked to rate their level of awareness of marine science, technology, engineering and math (STEM) careers before building their ROV. They were then asked if they knew more about STEM careers after building their ROV, and if so, how much more. There were no statistically significant differences between the responses of the under-represented students, when compared to the other students. Both groups reported increased STEM career awareness.

Interest in STEM Careers

The survey asked students if their ROV project made them more interested in a marine career, less interested, or didn't affect their level of interest. Across the board, students indicated that their ROV project had made them more interested in a marine career. There were no significant differences by gender, ethnicity, socio-economic status, or disability status.

Interest in STEM Topics

The survey explored interest in STEM topics in two different ways. First, the survey asked if the students' ROV project made them want to learn more about marine science, technology and engineering. There were no differences by ethnicity, socioeconomic status or disability. However, while gains were high across both genders, males were more likely to state that their ROV experience made them want to learn more about marine science, technology and engineering (male: 76%, female: 67%).

Next, the students were asked if their ROV project increased their desire to take any of a list of courses. Students could mark as many courses as they wished out of a list including math, computer science, engineering, science, and hands-on classes or club activities. There were statistically significant differences in the courses that the students marked:

- **Gender:** There were no significant differences between the genders in their increased desire to take math, science, computer science, or hands-on classes or clubs. However, male students were more likely than females to state that the project increased their desire to study engineering (male: 67%, female: 45%).
- **Ethnicity:** Students with minority backgrounds were significantly more likely to state that their ROV project increased their desire to take math courses (minority: 45%, white: 27%). There were no significant differences by ethnicity in the increased desire to take science, computer science, engineering or hands-on classes.
- **Socioeconomic status:** There were no significant differences between the responses of the students living in high and low poverty areas.
- **Disability status:** There were no significant differences between the responses of the students with and without disabilities.

STEM Knowledge

There were no statistically significant differences in the gains in knowledge about WWII shipwrecks between the under-represented students and the other students. Similarly, there were no significant differences in the percentage of students who knew what an ROV was before they built one, indicating a similar level of exposure to the topic before joining the program.

CONCLUSIONS

Overall, the MATE Center successfully implemented the third year of ITEST grant activities, expanding the SCOUT class ROV competition from eight to twelve regions across the country. Activities supporting the entry-level ROV competition included conducting hundreds of student and teacher workshops, as well as the week-long Summer Institute, that engaged over 3,300 middle school students and over 240 teachers.

Evaluation results continue to show strong positive outcomes for both teachers and students. For the third year, the professional development activities were effective in increasing teachers' understanding of ocean STEM careers, strengthening their commitment to lead middle school teams in the ROV competition, and improving their confidence in facilitating STEM learning experiences.

Input from students, teachers and parents all pointed to the strong gains made by students. Involvement in the ROV competition generated greater awareness and interest in pursuing STEM careers, increased interest in studying STEM topics, improved STEM knowledge and skills, and increased teamwork, critical thinking and problem solving skills.

Parents were passionate supporters of their children's involvement in the program, with comments such as "It was like a booster shot of wanting to learn. Best learning experience we've ever encountered." Educational research has stressed the importance of family support in a students' choice to follow a STEM career path. Evaluation results show that the ROV program impacted the participants' parents as well, making it easier for them to picture their child in a STEM career.

This is the second year that the evaluation was able to dig deeper into the effectiveness of the competition for under-represented students: females, minority ethnicities, students living in high poverty areas and students with disabilities. Overall, the evaluation continued to find that the program was effective in producing positive results for under-represented students as well as the students who traditionally participate in STEM learning opportunities.

After the final, no-cost extension year of the grant, the final evaluation report will be produced. This report will be summative, tracing the trends and impacts of the program across the four years of the grant and its plans for sustainability in future years.

APPENDIX: DETAILED EVALUATION PLAN AND PROTOCOLS

The appendix includes the following items:

- Detailed evaluation plan
- Competition
    - Student post-competition survey protocol (English & Spanish)
    - Faculty/mentor post-competition survey protocol (English)
    - Parent/guardian post-competition survey protocol (English & Spanish)
    - Judge/volunteer post-competition survey protocol (English)
- Workshops
    - Faculty/mentor pre-post workshop survey protocol
- Summer Institute
    - Summer Institute feedback and six-month follow-up survey protocols

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 important to us!* When you complete the survey, return it to your instructor, who will return it to the MATE Center. You can also return it directly to a MATE Center representative.

Thank you!

Please use a #2 pencil to answer the questions

MARKING INSTRUCTIONS

- **Use a No. 2 pencil only**
- Do not use ink, ballpoint, or felt tip pens.
- Make solid marks that fill the response completely.
- Erase cleanly any marks you wish to change.
- Make no stray marks on this form.

CORRECT: ● **INCORRECT:** ✓ ⊗ ◐

Q1. How would you rate your experience building and competing with your ROV?

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Very poor

Q2. Was this your first time building an ROV?

- ◯ Yes
- ◯ No

Q3. Did you know what an ROV was <u>before you built one</u>?

- ◯ Yes
- ◯ No

Q4. <u>Before building your ROV</u>, how much did you know about careers in marine science, technology, and engineering?

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

Q5. <u>After building your ROV</u>, do you know more about marine careers?

- ◯ Yes
- ◯ No -- **Skip to Q7**

Q6. How much more do you know about marine careers now?

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

Q7. Are you interested in having a career in marine science, technology, or engineering?

- ◯ Yes
- ◯ No
- ◯ Not sure

Regional event code:

Q8. Has your ROV project made you more interested in a marine career? Less interested? No difference?

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

Q9. What career would you like to have when you finish school? *(Please print.)*

Q10. Has your ROV project made you want to learn *more* about science, technology, and engineering?

- ◯ Yes
- ◯ No
- ◯ Not sure

Q11. Has your ROV project *increased* your desire to take any of these courses? *(Mark ALL that apply.)*

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

Q12. Have you or your school received an award or honor as a result of your ROV project?

- ◯ Yes -- Please describe:
- ◯ No

Q13. Has your ROV project opened up other education or career opportunities for you (e.g., strengthened college application, scholarship, internship, job offer)?

- ◯ Yes -- Please describe:
- ◯ No

This year's competition theme highlighted the role that ROVs play in assessing WWII shipwrecks that may contain hazardous materials.

Q14. *Before* you began your research for this competition, how much did you know about WWII shipwrecks?

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

Q15. *After* completing your research for this competition, how much do you know now about WWII shipwrecks?

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

Q16. Do you want to learn *more* about WWII shipwrecks, including how ROVs can be used to assess them?

- ◯ Yes
- ◯ No
- ◯ Not sure

Q17. What resources did you use in your research? *(Mark ALL that apply.)*

- ◯ Websites (Which ones):
- ◯ Journals, newsletters, and other print publications
- ◯ Interviews with working professionals or employers
- ◯ Teachers or parents
- ◯ Other (Please describe):

Some questions about you:

Q18. What is your grade level? *(If you are completing this during the summer, please mark the grade you attended in the school year that just finished.)*

Elementary, Middle School, and Junior High

- ◯ Kindergarten
- ◯ 1st grade
- ◯ 2nd grade
- ◯ 3rd grade
- ◯ 4th grade
- ◯ 5th grade
- ◯ 6th grade
- ◯ 7th grade
- ◯ 8th grade

High School

- ◯ Freshman
- ◯ Sophomore
- ◯ Junior
- ◯ Senior

Community or Technical College

- ◯ Year 1
- ◯ Year 2

Four-Year College or University

- ◯ Freshman
- ◯ Sophomore
- ◯ Junior
- ◯ Senior

Other -- *(Please describe)*

Q19. What competition class did you participate in?

- ◯ EXPLORER
- ◯ RANGER
- ◯ SCOUT

Regional event code:

Q20. What is your home zip code?

zip code

Q21. What is your team name? *(Please print.)*

Q22. What is your gender?

- ◯ Male
- ◯ Female

Q23. 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 describe

Q24. Do you have any disabilities that require accommodations?

- ◯ Yes
- ◯ No
- ◯ Prefer not to respond

Q25. Do you have any comments that you would like to share about your experience in the program? If so, please write them in the box below.

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!

Please return your completed evaluation to your teacher or a MATE Center representative

Estimable Alumno:

Esta encuesta está siendo circulada por el Centro (MATE) Educación de Tecnología Avanzada Marítima, con sede en Monterey Península College en Monterey, California. El Centro MATE es un programa nacional financiado por la Fundación Nacional de Ciencia para ayudar a preparar a los alumnos para carreras como marinos profesionales. ¡La información que usted provea en esta encuesta es importante para nosotros! Cuando complete la encuesta, regrésela a su instructor quien a su vez lo regresará al Centro MATE. Usted también puede regresárselo directamente a su representante del Centro MATE.

¡Muchas gracias!

Use lápiz #2 para responder las preguntas

Q1. ¿Cómo calificarías la experiencia de construir y competir con el ROV?

- ◯ Excelente
- ◯ Buena
- ◯ Más o Menos
- ◯ Mal
- ◯ Muy mal

Q2. ¿Fue esta la primera vez que construyes un ROV?

- ◯ Sí
- ◯ No

Q3. ¿Sabías lo que era un ROV <u>ántes de construír uno</u>?

- ◯ Sí
- ◯ No

Q4. <u>Antes de construír tu ROV</u>, ¿qué tanto sabías de carreras en la ciencia maritima, tecnología, e ingeniería?

- ◯ Mucho
- ◯ Algo
- ◯ Un poco
- ◯ Nada

Q5. <u>Después de construír tu ROV</u>, ¿sabes mas acerca de carreras marítimas?

- ◯ Sí
- ◯ No **>>> Brincar a la Pregunta 7**

Q6. ¿Qué tanto sabes ahora de las carreras marítimas?

- ◯ Mucho más
- ◯ Algo más
- ◯ Un poco más
- ◯ No más

Q7. ¿Estas interesado en tener una carrera en ciencia marítima, tecnología o ingeniería?

- ◯ Sí
- ◯ No
- ◯ No estoy seguro/a

INSTRUCCIONES DE MARCAR

- **Usar Únicamente lápiz # 2.**
- No usar tinta, bolígrafo, o rotuladores.
- Marquen sólido y llenen la respuesta completamente.
- Borrar claramente cualquier marca que desea cambiar.
- No hacer marcas de ninguna clase en el formulario.

CORRECT: ● **INCORRECT:** ⊘ ⊗ ◐

Regional event code:

Q8. ¿El proyecto ROV aumentó tu interés en Carrera marítima? ¿Menos interesado? ¿No hay diferencia?

- ◯ Más interesado
- ◯ Menos interesado
- ◯ No hay diferencia

Q9. ¿Qué carrera te gustaría tener cuando termines tu preparatoria? *(Favor de imprimir.)*

Q10. ¿Tu proyecto ROV te ha hecho querer aprender <u>más</u> respecto a ciencia, tecnología, e ingeniería?

- ◯ Sí
- ◯ No
- ◯ No estoy seguro/a

Q11. ¿Tú proyecto ROV aumentó tu deseo de tomar estos cursos? *(Marcar todo lo que se aplica.)*

- ◯ Matemáticas
- ◯ Ciencia en Computación
- ◯ Ingeniería
- ◯ Ciencia (i.e., física, química, biología, ciencia de la tierra, etc.)
- ◯ Clases a la mano o actividades de club como robóticos, electrónica, cursos de taller
- ◯ Ninguna

Q12. ¿Ha recibido tu escuela un premio de honor como resultado de tu proyecto ROV?

- ◯ Sí >> Favor de describir:
- ◯ No

Q13. ¿Tu proyecto ROV abrió otras oportunidades de educación o carreras para ti *(ejemplo., reforzó la solicitud de ingreso al colegio, becas, internado, oferta de empleo)***?**

- ◯ Sí >> Favor de describir:
- ◯ No

El tema de la competición de este año señaló el papel que ROV tiene en asesorar los naufragios de WWII que pueden contener materiales peligrosos.

Q14. <u>Antes de comenzar tu investigación de esta competencia</u>, ¿Qué tanto sabes de los naufragios de WWII?

- ◯ Mucho
- ◯ Algo
- ◯ Un poco
- ◯ Nada

Q15. <u>Al completar tu investigación para esta competencia</u>, ¿Qué tanto sabes de los naufragios de WWII?

- ◯ Mucho
- ◯ Algo
- ◯ Un poco
- ◯ Nada

Q16. ¿Quieres saber mas respecto a los naufragios de WWII, incluyendo cómo se puede usar ROV para asesorarlos?

- ◯ Sí
- ◯ No
- ◯ No estoy seguro/a

Q17. ¿Qué recursos usaste en tu investigación? *(Marca TODO lo que se aplica.)*

- ◯ Sitios web (¿cuales?): _____
- ◯ Libros, noticieros, y otros documentos imprimidos
- ◯ con profesionales del empleo, o los empleadores
- ◯ Maestros o padres
- ◯ Otros (favor de describir): _____

Algunas preguntas sobre ti:

Q18. ¿ Cuál es tu nivel de grado? *(Si lo estás completando durante el verano, favor de marcar el grado que asististe en el año escolar que acaba de terminar.)*

Escuela primaria, intermedia y Secundaria

- ◯ Kinder
- ◯ Primer grado
- ◯ 2nd grado
- ◯ 3er grado
- ◯ 4to grado
- ◯ 5to grado
- ◯ 6to grado
- ◯ 7 Septimo grado
- ◯ 8to grado

Escuela Secundaria

- ◯ Primer año
- ◯ Segundo año
- ◯ Tercer año
- ◯ último año

Colegio Técnico o de la Comunidad

- ◯ Año 1
- ◯ Año 2

Universidad o Colegio de Cuatro-Años

- ◯ Primer año
- ◯ Segundo año
- ◯ Tercer año
- ◯ último año

Otros >> *(Favor de describir)*

Q19. ¿En qué clase de competición participaste?

- ◯ EXPLORADOR/A
- ◯ GUARDA BOSQUES
- ◯ SCOUT

Regional event code:

Q20. ¿Cuál es el Código Postal?

Código postal

Q21. ¿Cuál es el nombre de tu equipo? *(Favor de imprimir)*

Q22. ¿Cuál es tu género?

- ◯ Malesculino
- ◯ Femenino

Q23. ¿Qué es lo que describe mejor tu etnicidad? *(Puedes marcar mas de uno.)*

- ◯ Blanco
- ◯ Afro-Americano/Negro
- ◯ Hispano/Latino/a
- ◯ Asiático
- ◯ Filipino/a
- ◯ Isleño del Pacífico
- ◯ Indio Americano o Nativo de Alaska
- ◯ Etnicidades Múltiples
- ◯ Otros >> Favor de describir

Q24. ¿Tienes discapacidades que requieren acomodaciones?

- ◯ Sí
- ◯ No
- ◯ Prefiero no responder

Q25. Tienes algunos comentarios que desees compartir respecto a tu experiencia en el programa? Si es así, favor de escribirlos en la caja de abajo.

Una manera fácil para ti de comunicarte con el Centro MATE y que MATE se pueda comunicar contigo – es por el sitio web de MATE alumni,"AlumniWeb", en www.marinetech.org/alumni. Les damos gracias por registrarse y agradeceríamos saber de su progreso a través de los años al progresar en su educación y carrera!

¡MUCHAS GRACIAS!

Favor de regresar la evaluación completa a su maestro o al representante del Centro MATE

MATE ROV Competition -- Instructor/Mentor Survey

Dear Instructor/Mentor:

This survey is being circulated by the Marine Advanced Technology Education (MATE) Center to help us improve the quality of the program and future events. *The information that you provide on this survey is confidential and important to us!* Only summary results will be reported. Return your completed survey to a MATE Center representative.

Thank you!

Please use a #2 pencil to answer the questions

MARKING INSTRUCTIONS

- **Use a No. 2 pencil only**
- Do not use ink, ballpoint, or felt tip pens.
- Make solid marks that fill the response completely.
- Erase cleanly any marks you wish to change.
- Make no stray marks on this form.

CORRECT: ● **INCORRECT:** ✓ ⊗ ◐

Q1. Overall, how would you rate the usefulness of the ROV program?

- ○ Excellent
- ○ Good
- ○ Fair
- ○ Poor
- ○ Very poor

Q2. How would you rate the support provided by the ROV program?

- ○ Excellent
- ○ Good
- ○ Fair
- ○ Poor
- ○ Very poor

Q3. What obstacles did you face in the ROV program this year? *(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
- ○ None

Q4. We are interested in hearing about changes you may have observed in your students since they began designing and building their ROV. Please indicate how much you agree or disagree with each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A. *My students are more interested in learning about science, technology, engineering, and math (STEM).*	○	○	○	○	○
B. *My students are more interested in pursuing a STEM career.*	○	○	○	○	○
C. *My students have increased their STEM knowledge and skills.*	○	○	○	○	○
D. *My students have increased their skills in team building, problem solving, and/or critical thinking.*	○	○	○	○	○

Regional event code:

Q5. We are interested in hearing your opinions about the usefulness of the program and how you incorporated the program materials into your course or club. Please indicate the degree to which you agree or disagree with each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A. *The ROV program provided a valuable venue to help prepare my students for careers in marine science & technology.*	○	○	○	○	○
B. *I modified my course/club curriculum based on MATE information and training so that my students could participate in the ROV program.*	○	○	○	○	○
C. *I used MATE materials/resources to incorporate the ROV building project into my course or club.*	○	○	○	○	○
D. *I intend to use what I learned through the project to work with future students.*	○	○	○	○	○

Q6. Has the ROV program opened up other education or career opportunities <u>for you</u>? *(E.g., professional development opportunities, partnerships with other schools/industry, job offers, etc.)*

○ Yes -- Please describe:
○ No

Q7. Has the ROV program opened up other education or career opportunities <u>for your students</u>? *(E.g., scholarships, internships, job offers, etc.)*

○ Yes -- Please describe:
○ No

Some questions about your team

Q8. This year, did your team receive support from the MATE Center's ITEST grant?

○ Yes
○ No
○ Not sure

Q9. How many students worked on this project?

☐☐ # of students

Q10. Overall, how much elapsed time did the students spend on the ROV project?

☐☐ months

Q11. Over the period that you and your students worked on the ROV project, approximately how many times did you meet per month?

☐☐ meetings per month

Q12. What competition class did your team participate in?

- ◯ EXPLORER
- ◯ RANGER
- ◯ SCOUT

Some questions about you

Q13. Are you a...? *(Mark ALL that apply.)*

- ◯ Teacher/faculty member
- ◯ Working professional (outside of the school system)
- ◯ After-school program or club coordinator
- ◯ Parent of an ROV team member
- ◯ Other

Q14. What audience do you teach and/or mentor? *(Mark ALL that apply.)*

- ◯ Elementary
- ◯ Middle/junior high school
- ◯ High school
- ◯ 2-year college or technical institution
- ◯ 4-year college or university
- ◯ Other (Please describe):

Q15. How many years have your worked with an ROV team from the school or club that you are representing today?

- ◯ 1 year
- ◯ 2 years
- ◯ 3 - 5 years
- ◯ 6 or more years

Q16. This year, did you attend any workshops related to the ROV program?

- ◯ Yes
- ◯ No
- ◯ Not sure

Regional event code:

Q17. How did you incorporate this project into your curriculum?

- ◯ Part of a course
- ◯ After-school club
- ◯ Voluntary activity
- ◯ Other

Q18. What is your gender?

- ◯ Male
- ◯ Female

Q19. 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 describe

Q20. Do you have any disabilities?

- ◯ Yes
- ◯ No
- ◯ Prefer not to respond

Q21. Do you have any comments that you would like to share about your experience with the program and/or your students' experiences in the program? If so, please write them in the box below.

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 career!

THANK YOU!

Please return your completed evaluation to a MATE Center representative

Competencia MATE ROV -- Encuesta para Padres

Estimables Padres: Esta encuesta está siendo distribuida por el Centro de Educación Avanzada de Tecnología Marina (MATE) , con sede en Monterey Peninsula College en Monterey, California. El Centro MATE es un programa nacional fundado por la Fundación de Ciencia Nacional para ayudar a preparar a los alumnos para carreras como profesionales marítimos.

La información que usted proporcione nos ayudará a continuar mejorando nuestro programa! Todas sus respuestas se mantendrán anónimas. Al completar la encuesta, regrese esta al instructor de su hijo o a un representante del Centro MATE.

Muchísimas gracias

Use lápiz #2 para responder las preguntas

INSTRUCCIONES DE MARCAR

- **Usar Únicamente lápiz # 2.**
- No usar tinta, bolígrafo, o rotuladores.
- Marquen sólido y llenen la respuesta completamente.
- Borrar claramente cualquier marca que desea cambiar.
- No hacer marcas de ninguna clase en el formulario.

CORRECT: ● **INCORRECT:** ✓ ⊗ ◐

Q1. ¿Cómo calificarías la experiencia de su hijo de construir y competir con un ROV (robot sumergido en el agua)?

- ○ Excelente
- ○ Buena
- ○ Más o Menos
- ○ Mal
- ○ Muy mal
- ○ No estoy seguro/a

Q2. El construir un ROV hizo a su hijo/a más interesado/a en ciencia, matemáticas, tecnología, o ingeniería? ¿Menos interesado? ¿No hay diferencia?

- ○ Más Interesado
- ○ Menos Interesado
- ○ No hay Diferencia
- ○ No estoy seguro/a

Q3. ¿Qué tan valiosa calificas esta competencia para el desarrollo educacional de su hijo/hija?

- ○ Extremamente valiosa
- ○ Muy valiosa
- ○ Algo de valiosa
- ○ Levemente valiosa
- ○ No tan valiosa

Q4. ¿El construír un ROV afectó las calificaciones de su hijo/a en cualquiera de las materias anotadas abajo?

	Calificaciones Mejoraron	No hubo Diferencia	Calificaciones Declinaron	No estudia esa materia
Ciencia	○	○	○	○
Matemáticas	○	○	○	○
Computadoras	○	○	○	○
Inginieria/Roboticas	○	○	○	○
Otros (especifique): _____	○	○	○	○

Q5. ¿Qué cambios ha visto en su hijo/a como resultado de su involucramiento en el proyecto ROV?
(Marcar todo lo que aplica.)

- ○ Mas organizado
- ○ Puede trabajar mejor con otros
- ○ Mejoró su confianza en sí mismo
- ○ Otros cambios (Favor de describir): _____

Q6. ¿La participación en el programa ROV ha cambiado sobre cómo imaginar el futuro de su hijo/a? Es más fácil visualizar a su hijo con una carrera en ciencia, tecnología, ingeniería, o matemáticas?

- ◯ Si
- ◯ No
- ◯ No estoy seguro/a

Q7. Como padre, ¿Qué tanta influencia tiene en la selección de carreras de su hijo/a?

- ◯ Mucho
- ◯ Algo
- ◯ Ninguna
- ◯ No estoy seguro/a

Q8. ¿Su hijo/a asiste a una escuela...

- ◯ Elemental?
- ◯ Intermediaria/Pre-Secundaria?
- ◯ Secundaria?
- ◯ Colegio/Universidad?
- ◯ Otro (Favor de describir):

Q9. ¿En qué competición participa su hijo en clase?

- ◯ EXPLORADOR/A
- ◯ GUARDA BOSQUES
- ◯ SCOUT
- ◯ No estoy seguro/a

Q10. Estamos interesados en aprender acerca de las familias que tienen varios niños que participan en la competición. ¿Cuántos de sus hijos han participado alguna vez?

de niños

Q11. ¿Tiene algún otro comentario que compartir acerca de la experiencia de su hijo en el programa de ROV? Si es así, por favor escriba en el siguiente cuadro.

¡MUCHISIMAS GRACIAS!

Por favor devuelva su evaluación realizada al instructor de su hijo/a o a un representante

Regional event code:

Competencia MATE ROV -- Encuesta para Padres

Estimables Padres: Esta encuesta está siendo distribuida por el Centro de Educación Avanzada de Tecnología Marina (MATE) , con sede en Monterey Peninsula College en Monterey, California. El Centro MATE es un programa nacional fundado por la Fundación de Ciencia Nacional para ayudar a preparar a los alumnos para carreras como profesionales marítimos.

La información que usted proporcione nos ayudará a continuar mejorando nuestro programa! Todas sus respuestas se mantendrán anónimas. Al completar la encuesta, regrese esta al instructor de su hijo o a un representante del Centro MATE.

Muchísimas gracias

Use lápiz #2 para responder las preguntas

INSTRUCCIONES DE MARCAR

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- No usar tinta, bolígrafo, o rotuladores.
- Marquen sólido y llenen la respuesta completamente.
- Borrar claramente cualquier marca que desea cambiar.
- No hacer marcas de ninguna clase en el formulario.

CORRECT: ● **INCORRECT:** ✓ ⊗ ◐

Q1. ¿Cómo calificarías la experiencia de su hijo de construir y competir con un ROV (robot sumergido en el agua)?

- ○ Excelente
- ○ Buena
- ○ Más o Menos
- ○ Mal
- ○ Muy mal
- ○ No estoy seguro/a

Q2. El construir un ROV hizo a su hijo/a más interesado/a en ciencia, matemáticas, tecnología, o ingeniería? ¿Menos interesado? ¿No hay diferencia?

- ○ Más Interesado
- ○ Menos Interesado
- ○ No hay Diferencia
- ○ No estoy seguro/a

Q3. ¿Qué tan valiosa calificas esta competencia para el desarrollo educacional de su hijo/hija?

- ○ Extremamente valiosa
- ○ Muy valiosa
- ○ Algo de valiosa
- ○ Levemente valiosa
- ○ No tan valiosa

Q4. ¿El construír un ROV afectó las calificaciones de su hijo/a en cualquiera de las materias anotadas abajo?

	Calificaciones Mejoraron	No hubo Diferencia	Calificaciones Declinaron	No estudia esa materia
Ciencia	○	○	○	○
Matemáticas	○	○	○	○
Computadoras	○	○	○	○
Inginieria/Roboticas	○	○	○	○
Otros (especifique): _____	○	○	○	○

Q5. ¿Qué cambios ha visto en su hijo/a como resultado de su involucramiento en el proyecto ROV?
(Marcar todo lo que aplica.)

- ○ Mas organizado
- ○ Puede trabajar mejor con otros
- ○ Mejoró su confianza en sí mismo
- ○ Otros cambios (Favor de describir): _____

Q6. ¿La participación en el programa ROV ha cambiado sobre cómo imaginar el futuro de su hijo/a? Es más fácil visualizar a su hijo con una carrera en ciencia, tecnología, ingeniería, o matemáticas?

- ◯ Si
- ◯ No
- ◯ No estoy seguro/a

Q7. Como padre, ¿Qué tanta influencia tiene en la selección de carreras de su hijo/a?

- ◯ Mucho
- ◯ Algo
- ◯ Ninguna
- ◯ No estoy seguro/a

Q8. ¿Su hijo/a asiste a una escuela...

- ◯ Elemental?
- ◯ Intermediaria/Pre-Secundaria?
- ◯ Secundaria?
- ◯ Colegio/Universidad?
- ◯ Otro (Favor de describir):

Q9. ¿En qué competición participa su hijo en clase?

- ◯ EXPLORADOR/A
- ◯ GUARDA BOSQUES
- ◯ SCOUT
- ◯ No estoy seguro/a

Q10. Estamos interesados en aprender acerca de las familias que tienen varios niños que participan en la competición. ¿Cuántos de sus hijos han participado alguna vez?

de niños

Q11. ¿Tiene algún otro comentario que compartir acerca de la experiencia de su hijo en el programa de ROV? Si es así, por favor escriba en el siguiente cuadro.

¡MUCHISIMAS GRACIAS!

Por favor devuelva su evaluación realizada al instructor de su hijo/a o a un representante

Regional event code:

MATE ROV Competition -- Volunteer Survey

Dear MATE ROV Competition Volunteer: This survey is being circulated by the Marine Advanced Technology Education (MATE) Center to help us to continue to improve the quality of the program and future events. The information that you provide on this survey is confidential and important to us!

The information you provide will help us to continue to improve our program! All of your responses will remain confidential. When you complete the survey, return it to a MATE Center representative.

Thank you!

Please use a #2 pencil to answer the questions

MARKING INSTRUCTIONS

- **Use a No. 2 pencil only**
- Do not use ink, ballpoint, or felt tip pens.
- Make solid marks that fill the response completely.
- Erase cleanly any marks you wish to change.
- Make no stray marks on this form.

CORRECT: ● **INCORRECT:** ✓ ⊗ ◑

Q01. What was your role in the competition? *(Please mark all that apply.)*

- ○ Poolside mission judge
- ○ Engineering judge
- ○ Poster judge
- ○ Technical support
- ○ General competition support (e.g., registration desk)
- ○ Ocean Career Expo participant
- ○ Other, please describe: _____

Q02. Did you spend most of your time working with the EXPLORER competition class, the RANGER class, or both?

- ○ EXPLORER
- ○ RANGER
- ○ Both competition classes
- ○ Not applicable

Q03. Please rate your experience with each of the following aspects of the MATE ROV competition.

	EXCELLENT	GOOD	FAIR	POOR	VERY POOR	DON'T KNOW
A. Overall experience volunteering with the MATE ROV program	○	○	○	○	○	○
B. The ROV competition support provided to the judges and volunteers (information, guidance, logistics, etc.)	○	○	○	○	○	○

Q04. Please mark the extent to which you agree or disagree with the following statements

	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	DON'T KNOW
A. Volunteering in the ROV program was a worthwhile use of my time.	○	○	○	○	○	○
B. Volunteering in the ROV program was a rewarding experience.	○	○	○	○	○	○
C. I would volunteer again at a future competition.	○	○	○	○	○	○

Q05. Please mark the extent to which you agree or disagree with the following statements about the ROV program:

The ROV program helps...

	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	DON'T KNOW
...prepare students for **careers** in marine science, technology and engineering.	○	○	○	○	○	○
...motivate students to **learn** science, technology, engineering and math.	○	○	○	○	○	○
...strengthen students' **21st Century Skills,** such as teamwork and critical thinking.	○	○	○	○	○	○

Q06. Thinking about the majority of the students at the competition, please rate their skills in the following areas:

	EXCELLENT	GOOD	FAIR	POOR	VERY POOR	DON'T KNOW
Content knowledge in science, technology, and/or engineering	○	○	○	○	○	○
Critical thinking	○	○	○	○	○	○
Teamwork	○	○	○	○	○	○
Professionalism	○	○	○	○	○	○

Q07. Do you currently work in a technology related field?

- ○ Yes
- ○ No -- **Skip to Q10**

Q08. If an entry-level job or internship were available at your organization, would you consider the students at the competition to be strong candidates?

- ○ Yes, definitely
- ○ Yes, probably
- ○ No, probably not
- ○ No, definitely not
- ○ Don't know

Q09. Has your organization hired any students who participated in the MATE ROV program?

- ○ Yes -- **How many?** _____
- ○ No
- ○ Don't know

Q10. How many years have you volunteered with the MATE ROV program?

_____ years

Q11. Have you ever competed in a MATE ROV competition? *(Mark all that apply.)*

- ○ Yes, as a student
- ○ Yes, as a mentor
- ○ No

Q12. What is your gender?

- ○ Male
- ○ Female

Q13. What would you say best describes your ethnicity? *(Mark all that apply.)*

- ○ White
- ○ African American/Black
- ○ Hispanic/Latino/a
- ○ Asian
- ○ Filipino/a
- ○ American Indian or Alaskan Native
- ○ Pacific Islander
- ○ Multiple ethnicities
- ○ Other, please describe:

Q14. Do you have any disabilities?

- ○ Yes
- ○ No
- ○ Prefer not to respond

Q15. Do you have any comments you would like to share about your experiences as a volunteer? Write them in the space below.

Please return your completed survey to a MATE Center representative

MATE ROVER* Teacher Workshop

*ROV Education and Resources

Saturday, February 4, 2012

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 in designing and building an ROV?
   - ☐ 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, January 22, 2011

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?
   - ☐ Excellent
   - ☐ Good
   - ☐ Fair
   - ☐ Poor

2. After this training, 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

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

more ⟶

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

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

1. Summer Institute (ITEST Session) Feedback Form 2011

Your feedback to MATE about the Summer Institute will help us to improve the quality of similar institutes in the future. Please use this form to provide us with your comments. If there is not enough room on this form for all your comments in response to a particular question, please feel free to send an additional email and note the number of the question you are responding to. Thank you!

Please note:
** The MATE independent evaluator will send all institute participants a brief follow-up survey this fall. The survey will aim to assess the longer-term impact of the institute. We would very much appreciate your prompt response to that survey when it arrives. Thank you! **

1. What grade/level do you teach? Check All that Apply.

- [ ] Elementary
- [ ] Middle/ Junior High School
- [ ] High School
- [ ] 2-yr College or technical institution
- [ ] 4-yr College or university
- [ ] Other (Please describe)

2. What subject(s) do you teach? Check all that Apply.

- [ ] Math
- [ ] Science (biology, physics, chemistry, etc.)
- [ ] Marine Science and/or Technology
- [ ] Engineering
- [ ] Computer Science
- [ ] English
- [ ] Other (Please describe)

3. How many years have you been teaching?

4. Approximately how many students do you teach in one year? (Please don't double count students who are in more than one of your classes.)

5. Did the Institute clearly address the topic(s) you came to learn about?

- ◯ Yes, right on
- ◯ Pretty much
- ◯ Somewhat, but not entirely
- ◯ Just marginal
- ◯ No, not at all
- ◯ Other (please specify)

6. Overall, were the sessions well-led and well-organized, with ample opportunity for participant interaction?

- ◯ Yes, first-rate
- ◯ Yes, pretty much
- ◯ Not bad
- ◯ Only fair
- ◯ No, they were pretty ragged
- ◯ Other

Comments

7. How useful were the MATE Institute workshops and presentations?

	Not Useful at All	Not Very Useful	Somewhat Useful	Pretty Useful	Very Useful
Guest speaker- Farley Shane, MBARI	◯	◯	◯	◯	◯
Guest speaker- Annemarie Sullivan, middle school teacher	◯	◯	◯	◯	◯
Guest speaker - DJ Osborne, MBARI Vessels	◯	◯	◯	◯	◯
ROV in a Bag exercise	◯	◯	◯	◯	◯
Lessons on soldering	◯	◯	◯	◯	◯
Lessons on frame building and design	◯	◯	◯	◯	◯
Lessons on electricity	◯	◯	◯	◯	◯
Building the ROV	◯	◯	◯	◯	◯
MBARI & Vessel Tour	◯	◯	◯	◯	◯
ROV competition	◯	◯	◯	◯	◯
ITEST Grant	◯	◯	◯	◯	◯
Ocean Careers -Deidre Sullivan, MATE Center	◯	◯	◯	◯	◯

8. Do you plan to use the information from this Institute in order to participate in the MATE/ MTS ROV Committee ROV competition?

- ◯ Yes
- ◯ Possibly
- ◯ No
- ◯ Don't know

9. Please indicate the degree to which you agree with each of the following statements by placing an check mark in the appropriate box.

	Not at All	A Little	A Fair Amount	A Great Deal
a. I intend to modify my curriculum based on the MATE information and training I received.	◯	◯	◯	◯
b. I intend to modify my teaching strategies based on the MATE information and training I received.	◯	◯	◯	◯
c. I intend to share the information offered in the MATE Institute with other instructors.	◯	◯	◯	◯

10. Please indicate the degree to which you agree with each of the following statements by placing an check mark in the appropriate box.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The MATE Institute provided valuable ideas that I can use in my courses.	◯	◯	◯	◯	◯
b. The MATE Institute helped me understand industry guidelines for marine technicians (including SCANS).	◯	◯	◯	◯	◯
c. The MATE Institute helped me identify course assessment strategies that are aligned with course objectives and industry guidelines.	◯	◯	◯	◯	◯
d. The MATE Institute provided me with instructional materials that will improve student preparedness for ocean-related occupations.	◯	◯	◯	◯	◯
e. The MATE Institute helped me understand current technologies used in the marine field.	◯	◯	◯	◯	◯
f. Using what I learned at the MATE Institute, I am planning to develop action plans for inserting instructional materials into existing curriculum.	◯	◯	◯	◯	◯
g. The MATE institute and literature helped me understand marine workforce/ROV information.	◯	◯	◯	◯	◯

11. What improvements or additions to the MATE Center's educational products and services do you think would be most valuable? Please check all that apply and add any comments you might have.

- [ ] materials that fit directly into traditional science courses
- [ ] materials that fit directly into traditional math courses
- [ ] materials that fit directly into traditional vocational courses
- [ ] curricula that I can implement as a new submersible technology course
- [ ] detailed, how-to manuals for construction of ROV components and other undersea instruments
- [ ] materials linked to national educational standards
- [ ] materials linked to occupational standards
- [ ] materials in hard copy formats
- [ ] CDs, web sites, videos, and other electronic materials
- [ ] Other

Comments:

12. What improved and additional opportunities for students do you think would be most valuable? Please check all that apply and add any comments you might have.

- [ ] internship programs
- [ ] summer institutes
- [ ] programs to match students with marine science and/or technology mentors
- [ ] career counseling
- [ ] other

Comments:

13. What improved and additional professional development activities for educators and mentors do you think would be most valuable? Please check all that apply and add any comments you might have.

- [ ] weekend workshops
- [ ] programs to match faculty and mentors with marine science and/or technology professionals
- [ ] discuss-and-share web sites for faculty and mentors
- [ ] internship and summer employment programs in marine science and technology
- [ ] training and support for educators to run workshops in their local area
- [ ] assistance with developing and writing curricula
- [ ] other

Comments:

14. Overall, how would you rate the usefulness of the Institute?

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

15. Were the overall logistics and transportation for the Institute well organized and satisfactory?

- ◯ Yes, first-rate
- ◯ Yes, pretty much
- ◯ Not bad
- ◯ Only fair
- ◯ No, they were inadequate
- ◯ Other

Comments:

16. Were you satisfied with the food that was provided during the Institute?

- ◯ Yes, first-rate
- ◯ Yes, pretty much
- ◯ Not bad
- ◯ Only fair
- ◯ No, it was inadequate
- ◯ Other

Comments:

17. Were you pleased with your hotel accommodations during the Institute?

- ◯ Yes, first-rate
- ◯ Yes, pretty much
- ◯ Not bad
- ◯ Only fair
- ◯ No, they were inadequate
- ◯ Other

Comments:

18. Overall Comments:

1. Default Section

Your response to this survey will provide MATE and NSF with essential information about the impact of the 2011 MATE Summer Institute. We have analyzed the feedback form you completed at the end of the Institute; this survey is designed to gather information about the longer-term impacts. Thank you for taking a few moments to share your opinions!

1. In retrospect, how would you rate the usefulness of the MATE Summer Institute?

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

2. Please review the statements below and mark the box that best reflects your opinions about the Institute. "The MATE Summer Institute..."

	Strongly Disagree	Disagree	Feel Neutral	Agree	Strongly Agree
Provided valuable ideas that I am using in my courses or programs.	◯	◯	◯	◯	◯
Helped me understand the knowedge and skills needed for marine occupations.	◯	◯	◯	◯	◯
Helped me understand current technologies used in the marine field.	◯	◯	◯	◯	◯
Provided instructional materials that will help my students become better prepared for ocean-related science, technology, engineering and math careers.	◯	◯	◯	◯	◯

3. To what extent have you implemented or shared the information from the MATE Summer Institute?

	Not at All	A Little	A Fair Amount	A Great Deal
I have modified the content of my course or program.	◯	◯	◯	◯
I have modified my teaching strategies.	◯	◯	◯	◯
I have shared the information offered at the Institute with other instructors.	◯	◯	◯	◯
I have shared the information offered at the institute with students.	◯	◯	◯	◯

4. Since the MATE Summer Institute, how useful have each of the workshops and presentations been for you?

	Not Useful at All	Not Very Useful	Somewhat Useful	Pretty Useful	Very Useful
Guest speaker- Farley Shane, MBARI	◯	◯	◯	◯	◯
Guest speaker- Annemarie Sullivan, middle school teacher	◯	◯	◯	◯	◯
Guest speaker - DJ Osborne, MBARI Vessels	◯	◯	◯	◯	◯
ROV in a Bag exercise	◯	◯	◯	◯	◯
Lessons on soldering	◯	◯	◯	◯	◯
Lessons on frame building and design	◯	◯	◯	◯	◯
Lessons on electricity	◯	◯	◯	◯	◯
Building the ROV	◯	◯	◯	◯	◯
MBARI & Vessel Tour	◯	◯	◯	◯	◯
ROV competition	◯	◯	◯	◯	◯
ITEST Grant	◯	◯	◯	◯	◯
Ocean Careers -Deidre Sullivan, MATE Center	◯	◯	◯	◯	◯

5. Reflecting on what you learned in the institute, please rate your knowledge and skills.

1. I have no knowledge or skills in this area.
2. I am familiar with this technology but have limited hands-on experience.
3. I can use this technology with some help.
4. I can use this technology on my own without any help.
5. I could teach another person how to use this technology.

	1	2	3	4	5
Understanding of electronics	◯	◯	◯	◯	◯
Understanding of electricity	◯	◯	◯	◯	◯
Ability to solder	◯	◯	◯	◯	◯
Ability to use a multimeter to measure current, voltage, and resistance	◯	◯	◯	◯	◯
Understanding of sensors	◯	◯	◯	◯	◯

6. Do you have any other feedback about the usefulness of the workshops and presentations?

7. Since attending the Institute, have you received any funding or support for your work with ROVs? If so, what type of funding or support? How much?

8. If you are not participating in the MATE ROV competition, are you doing anything else with ROV's? If so, please explain.

9. Have you come across any obstacles or barriers to implementing what you learned at the Summer Institute? If so, could you tell us about them?

10. Has your participation in the MATE Summer Institute opened new opportunities for you? If so, please explain.

11. How could MATE make the Summer Institutes more useful?

12. Please provide any additional comments you may have on the Summer Institute, including its impact on your instruction, courses, students, or institution.

13. Are you a classroom teacher?

- ◯ Yes
- ◯ No

Please specify your role/position

14. What audience do you teach? Check all that apply.

- ☐ Elementary
- ☐ Middle/ Junior High School
- ☐ High School
- ☐ 2-yr College or technical institution
- ☐ 4-yr College or university
- ☐ Other (Please describe)

15. What subject(s) do you teach? Check all that apply.

- ☐ Math
- ☐ Science (biology, physics, chemistry, etc.)
- ☐ Marine Science and/or Technology
- ☐ Engineering
- ☐ Computer Science
- ☐ English
- ☐ Other (Please describe)

16. How many years have you been teaching?

17. Approximately how many students do you teach in one year? (Please don't double count students who are in more than one of your classes.)

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)

MATE ROVER* Teacher Workshop

*ROV Education and Resources

Saturday, February 4, 2012
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 regional and international 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.
- Connect with a mentor who will work with a) you during the workshop and b) you and your students in the classroom.

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

When? 8:30am—5:30pm on Saturday, February 4th. **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
- Mentors who will visit your school to help deliver the 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 *BONUS* Workshop Day!

Saturday, February 25, 2012
1—5pm
Monterey Peninsula College

The MATE Center is offering a **BONUS** 1/2-day workshop to all ITEST ROVER teachers on Saturday, February 25 from 1-5pm at MPC's Automotive Technology facility. This workshop is optional, but important and helpful information will be covered, so we encourage you to attend!

This workshop is open to teachers who have participated in the ITEST ROVER program in the past and to the teachers who will participate in the ITEST ROVER February 4th workshop.

The goal of this workshop is to:

- Practice soldering skills, which includes learning how to solder motors onto an ROV's tether
- Learn basic troubleshooting techniques
- Review safety practices, including how to create a safe, productive workspace and how to appropriately handle lead acid batteries
- Answer questions about implementation, curriculum resources, building materials, tools, etc.
- Share challenges, triumphs, and lessons learned
- Network with teachers who have experience leading their students through ROV design and building *and* the MATE Monterey Bay Regional ROV Contest

If you are a new ITEST ROVER teacher interested in attending this bonus workshop, please mark the appropriate box on the application that follows. If you are a returning ITEST ROVER teacher, please contact Jill Zande at jzande@marinetech.org or (831) 646-3082 to attend.

MATE ROVER Teacher Workshop

Application deadline: January 23, 2012*

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

12. **Are you planning to attend the bonus 1/2-day workshop on Saturday, February 25?** a. Yes b. No

Demographics (yours, not your students)

13. **Gender**
    a. Female
    b. Male

14. **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 after-school club/course outline

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

- February – May
    - Schedule is based on 10 weeks, 2 days per week, 2 hours (2:30-4:30pm) per day = 40 hours contact time, one week of spring break, and one week of possible "slippage" or delay
- Course schedule
    - Week 1 – February 20 – 24
        - Introduction to ROVs
        - Demo workshop ROV
        - ROV-in-a-bag activity (borrow re-usable kits from the MATE Center)
        - Info about Monterey Bay regional contest, including the poster and engineering requirements
        - Info about after-school club mini-contest
        - Introduce and begin project note-booking
    - Week 2 – February 27 – March 2
        - 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
        - Tool use and battery safety
    - Week 3 – March 5 – 9
        - Electronics, simple circuits, and wiring the control box
        - Wiring the control box and motors
        - More wiring
        - Don't forget about note-booking along the way!
    - Week 4 – March 12 – 16
        - Finish the control box/motor assembly
        - Testing and troubleshooting
    - Week 5 – March 19 – 23
        - More testing and trouble-shooting
        - Design and piece together the frame
        - Incorporate the motors into the frame, work on buoyancy

    MILESTONE: Control box/motor assembly completed and operational

- Week 6 – March 26 – 30
  - Contact Kim Swan at kswan@marinetech.org to make sure that you are registered for the contest and to register for upcoming pool practice days (see below for pool practice dates)
  - Select and incorporate payload tools into the frame
  - Buoyancy testing
  - Practice piloting, fine-tune buoyancy
  - Don't forget about note-booking along the way!

- Week 7 – April 2 – 6
  - Testing and trouble-shooting
  - More work on payload tools
  - Testing and trouble-shooting
  - Practice piloting

MILESTONE: Payload tools completed and incorporated, ROV complete!

- Week 8 – April 9 – 13
  - Work on poster display and engineering Q&A
  - Practice piloting
  - Don't forget about note-booking along the way!
  - Start thinking about your mini-contest and let us know if you would like our help
  - If possible, attend pool practice day on Saturday, April 14 at Aptos High School

- Week 9 – April 16 – 20
  - Continue work on poster display and engineering Q&A
  - Practice piloting

- Week 10 – April 23 – 27
  - Continue work on poster display and engineering Q&A
  - Practice piloting
  - Mini-contest, if necessary, to determine team that competes in the regional
  - If possible, attend pool practice day on Saturday, April 28 at MPC

MILESTONE: Poster display completed

Additional time until contest can be used for practice, the poster display, and engineering Q&A

Saturday, May 12th – Monterey Bay Regional ROV Contest at MPC

Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

GRAY'S REEF NATIONAL MARINE SANCTUARY

Photo: Office of National Marine Sanctuaries

Photo: Greg McFall

Photo: Greg McFall

Sea Turtle Sprint

ROV Workshop, Competition and STEM Career Expo

An Innovative Technology Experience for Students and Teachers (ITEST)

Gray's Reef National Marine Sanctuary is pleased to offer 10 local middle school educators and 100 of their students the opportunity to participate in a remotely operated vehicle (ROV) design and building workshop and competition in the first ever *Sea Turtle Sprint and STEM Career Expo.*

The objective of the program is to build the infrastructure for an entry-level ROV competition class to participate in our regional event by providing professional development and student support workshops as well to increase ocean awareness through ROV-focused science, technology, engineering and mathematics (STEM) curriculum materials. Workshop participants learn to build and pilot a remotely operated vehicle then race their flying 'sea turtle' submersibles in the pool around man-made obstacles and natural threats to reach the safety of the reef.

Local universities and organizations offering STEM education programs and careers will be hosting booths to increase ocean STEM awareness and present trajectories to those careers for middle and high school audiences.

Schedule of Events

The workshops will take place every Thursday beginning January 19th through February 9th from 5pm - 8pm at the West Broad Street YMCA. All materials will be provided, along with food and refreshments for participants.
The culminating Sea Turtle Sprint competition will be held on Saturday, February 25th from 10am– 2pm with teams racing against a clock to successfully pilot their ROV 'sea turtle' to the safety of the reef.

Field Trip!

If that doesn't sound fun enough, workshop participants will also be invited to tour the French research vessel *TARA* which will be docked on River Street Saturday, January 21st. Meet the research team and find out about their 2.5 year expedition around the world! Transportation will be provided.

Sponsorship

Support for this project was provided by the Marine Advanced Technology Education (MATE) Center and the National Science Foundation in partnership with NOAA Gray's Reef National Marine Sanctuary. Special thanks to Savannah Chatham County Public School System, Georgia Technical College-Savannah Campus, West Broad Street YMCA and the TARA OCEAN expedition.
Find out more about our sponsors and partners by visiting their websites:

http://www.marinetech.org/
http://www.nsf.gov/
http://www.westbroadstreetymca.org/
http://oceans.taraexpeditions.org/
http://savannah.gatech.edu/

Contact: jody.patterson@noaa.gov (912-598-2431) http://graysreef.noaa.gov/

STANDARDS FOR MIDDLE GRADES TEACHERS WORKING ON THE ROV WORKSHOP

The following are a list of applicable GPS Standards for middle grades science instruction. Teachers who participate in the ROV Workshop will be exposed to these standards and will learn modeling techniques, inquiry instruction opportunities and discovery instruction strategies for use in their own classroom.

Sixth Grade:

S6CS3. Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.
a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers and decimals.
b. Use metric input units (such as seconds, meters, or grams per milliliter) of scientific calculations to determine the proper unit for expressing the answer.
c. Address the relationship between accuracy and precision and the importance of each.
d. Draw conclusions based on analyzed data.

S6CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.
a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files.
b. Estimate the effect of making a change in one part of a system on the system as a whole.
c. Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, and temperature, and choose appropriate units for reporting various quantities.

S6CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
b. Identify several different models (such as physical replicas, pictures, and analogies) that could be used to represent the same thing, and evaluate their usefulness, taking into account such things as the model's purpose and complexity.

S6CS6. Students will communicate scientific ideas and activities clearly.
a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.

S6E3. Students will recognize the significant role of water in earth processes.
a. Explain that a large portion of the Earth's surface is water, consisting of oceans, rivers, lakes, underground water, and ice.
c. Describe the composition, location, and subsurface topography of the world's oceans.

Seventh Grade:

S7L4. Students will examine the dependence of organisms on one another and their environments.
b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.
c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.
d. Categorize relationships between organisms that are competitive or mutually beneficial.
e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

Eighth Grade:

Teachers will be exposed to the following ideas and will learn to model these ideas in inquiry instruction:

S8CS2. Students will use standard safety practices for all classroom laboratory and field investigations.
a. Follow correct procedures for use of scientific apparatus.
b. Demonstrate appropriate techniques in all laboratory situations.
c. Follow correct protocol for identifying and reporting safety problems and violations

S8CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
a. Observe and explain how parts can be related to other parts in a system such as the role of simple machines in complex machines.
b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing.

S8P3. Students will investigate relationship between force, mass, and the motion of objects.
a. Determine the relationship between velocity and acceleration.
c. Demonstrate the effect of simple machines (lever, inclined plane, pulley, wedge, screw, and wheel and axle) on work.

Eighth Grade Research Standards:

S8SR1. Students will synthesize science content through standard science research protocols in earth, life, and physical science.

d. Determine appropriate research approaches to specific research problems in earth, life, and physical science.

S8SR2. Students will investigate an accessible scientific research problem in earth, life, or physical science.

a. Establish a research question from the middle school earth, life, or physical science GPS content.
b. Establish an appropriate research protocol for investigating the question, from within the science content of earth, life, and physical science.

S8SR4. Students will appropriately employ instrumentation and apply technological analysis to the accessible research question within earth, life, or physical science content.

a. Understand applicable data collection and analysis techniques for studying aspects of the system in question.
b. Establish systematic and appropriate data collection techniques (encourage using appropriate computer technology and/or remote sensing probe) appropriate to the science content.
c. Record data using appropriate technology.
d. Analyze data using appropriate technology.

2nd Annual MATE Center
ITEST Summer Institute
Beginner Level Remotely Operated Vehicle (ROV) Building for Class or Club Projects
July 6th – July 12th, 2011
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

	Level of Knowledge and Skills				
	None	**Basic**	**Intermediate**	**Advanced**	**Expert**
a. Electronics	☐	☐	☐	☐	☐
b. Electricity	☐	☐	☐	☐	☐
c. Soldering	☐	☐	☐	☐	☐

6. What is your ethnic background (Optional question)

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

7. What is your gender? (Optional question)

☐ Male
☐ Female

8. 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.

9. 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) _____

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

☐ No
☐ Yes – please specify _____

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

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

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

_____
_____
_____

13. 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, 2011. If you are applying later than May 30th, 2011 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

The 2nd Annual MATE Center ITEST Summer Institute
Beginner Level ROV Building for Classroom Projects
July 6th – July 12th, 2011

DAY 1- Wednesday, July 6th

TIME	ACTIVITY	LOCATION
1:30 pm	Trip to Monterey Bay Aquarium (OPTIONAL) Van pick –up at 1:30 pm Monterey Bay Lodge	Monterey Bay Aquarium
7:00 pm – 8:30 pm	Welcome reception – MATE will provide food and drinks	Monterey Bay Lodge pool area

DAY 2- Thursday, July 7th

TIME	ACTIVITY	LOCATION
8:00 am	Van leaves from Monterey Bay Lodge to travel to MPC	Monterey Peninsula College (MPC)- International Center room 102 (IC 102)
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)**	
9:00 am-9:45 am	**Goals for the week & Introduction to ROVs- Matt Gardner (MATE)**	
9:45 am -11:00 pm	**ROV in a Bag Building - And How Can I Get One? Matt & Erica**	
11:00 am – 11:15 am	Break	
11:15 am – 12:00 pm	**MATE's ITEST Grant: The Bigger Picture- Jill Zande (MATE Center, Associate Director and Competition Coordinator)**	
12:00 pm – 12:45 pm	Lunch	
12:45 pm – 1:15 pm	**ROV Competitions– Jill Zande (MATE)**	
1:15 pm – 1:45 pm	**Drive to MBARI**	
1:45 pm -3:00 pm	MBARI tour Farley **(MBARI)**	Monterey Bay Aquarium Research

3:00 pm -5:00 pm	MBARI vehicles- **George Matsumoto– (MBARI)**	Institute (MBARI) www.mbari.org http://www.philsfishmarket.com/
5:00 pm -5:30 pm	Tour the vessels **Knute Brekke (MBARI)**	
5:30 pm -6:30 pm	Dinner at Phil's & return to Hotel	

DAY 3- Friday, July 8th

TIME	ACTIVITY	LOCATION
8:00 am 8:15 am - 8:30 am	Van leaves from Monterey Bay Lodge to travel to MPC Breakfast (coffee and pastries)	MPC – IC 102
8:30 am – 9:30 am	**ROV in a Bag – motor movement exercise**	
9:30 am – 10:30 am	**Frame design, materials and methods : What is typically used and why**	
10:30 am – 10:45 am	**Break**	
10:45 am – 12:00 pm	**Designing with a purpose, group frame design and building**	
12:00 pm – 1:00 pm	**Lunch**	
1:00 pm – 2: 30 pm	Electricity! Electrical safety, basic electricity, how a switch operates and the use of a multimeter	
2:30 pm – 2:45 pm	Break	
2:45 pm – 4: 15 pm	Soldering workshop: Switches: Solder? Or Crimp?	
4:15 pm – 5:30 pm	Electrical Troubleshooting- What to do when things go wrong. Troubleshooting exercises	
5:30 pm – 9:00 pm	Building your ROV control box & attaching motors to tether.	
6:00 pm	Pizza Dinner & Lab time	

DAY 4- Saturday, July 9th

TIME	ACTIVITY	LOCATION
8:00 am 8:15 am – 8:30 am	Van leaves from Monterey Bay Lodge to travel to MPC Breakfast (coffee and pastries)	MPC – IC102
8:30 am – 9:15 am	Ocean Workforce & Workforce Development- Deidre Sullivan – Director, MATE Center	
9:15 am- 9:30 am	Break	
9:30 am- 11:30 am	Incorporating ROVs Into Your Curriculum- Anne Marie Sullivan	
11:30 am - 12:30pm	Flotation & Bollard discussions, demonstrations and practice	
12:30 pm – 1:30 pm	Lunch	
1:30 pm – 3:30 pm	Wiring up the frame & attaching motors. Creating motor mounts for your frame.	
3:30 pm – 3:45 pm	Break	
3:45 pm - 4:15 pm	**Batttery saftey demonstrations and creating your own power supply**	
4:15 pm – 5:30 pm	Building Underwater Cameras	
5:30 pm	Dinner – Small Groups or On Your Own	

DAY 5- Sunday, July 10th

TIME	ACTIVITY	LOCATION
8:00 am	Van leaves from Monterey Bay Lodge to travel to MPC	MPC- IC102
8:15 am – 8:30 am	Breakfast (coffee and pastries)	
8:30am -9:45 am	**Simple manipulators and Manipulators in the MATE textbook**	
9:45 am -10:00 am	Break	
10:00 am -11:00 am	**Connecting Cameras**	
11:00 am – 12:00 pm	**ROV Building**	
12:00-1:00 pm	Lunch	
1:00 pm – 6:00 pm	ROV Building & The White Van of Mystery Tour	

6:00-9:00	Lab and building time available Auto Tech cookout hosted by Matt & Jeremy	

DAY 6- Monday, July 11th

TIME	ACTIVITY	LOCATION
8:00 am	Van leaves from Monterey Bay Lodge to travel to MPC	MPC –IC102 MPC Pool
8:15 am – 8:30 am	Breakfast (coffee and pastries)	
8:30 am – 11:30 am	**Finish ROVs**	
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	
4:00 pm – 5:30 pm	Clean up the pool area and the Auto Technology lab and classroom	MPC Pool and IC 102 MPC Library – Sam Karas Room
7:00 pm- 10:00 pm	Closing dinner and team presentations	

Day 7- Tuesday, July 12th

TIME	ACTIVITY	LOCATION
10:00 am	Check out of Monterey Bay Lodge	Heading home ☺

2011 MATE Regional Coordinators' Meeting
November 10 – 11, 2011
Sam Karas Room, Library Technology Building
Monterey Peninsula College
Monterey, CA

Thursday, November 10th

8:00am: Breakfast

Sweet (pastries, jams and jellies) as well as savory (eggs, potatoes) breakfast items will be available.

8:30 – 8:45am: Welcome and introductions (continue eating!)

Please include how many years you've been involved with the MATE competition and share something interesting (non-work-related) about yourself!

8:45am – 12:00pm: COMPETITION

- **What does it mean to be a MATE regional?**
  - Before starting, attend a regional/international event and/or field a team
  - Follow the rules and specifications, especially when it comes to building props
  - Regionals are held at least 6 weeks in advance of the international competition date
  - Follow evaluation protocol/administer surveys
  - Manage your regional contest web site, which includes posting scores/results
    - Score sheets (make a copy, return originals to teams!)

- **Regional network – resources and support from the MATE Center**
  - Regional contest web sites
    - Backend tools
  - Communication/project management tools
    - BaseCamp
    - Google Docs
    - Dropbox

- **Regional network updates**
  - Update on Nova Scotia and Japan
  - New regional in Egypt
  - Potential future regional sites (Colorado, Alabama, New Hampshire)

- **Lessons learned from 2011 and suggestions for next year**

  This is list to get us started! Just remind us to take a break at some point during the discussions.

- Registration
  - Feedback on your end?
  - Planned improvements
  - Fees (accounting, process, etc.)

- Safety
  - Success of pneumatics/hydraulics quiz
  - Definition and example of a "true" inline fuse
  - EXPLORER class onboard power
  - EXPLORER class demonstration requirement

- Volunteer recruitment
  - Sources
  - Preparing judges

- "Professional boundaries"
  - Handling "over-anxious" coaches, mentors, and parents
  - Mentoring a team AND coordinating the event

- Suggestions for improving events (and making your life easier!)
  - Speaker from industry (if the event schedule permits) – focus on what they do and why they are volunteering at the event – the idea is to give students the motivation to explore beyond the competition
  - Scheduled social interaction (even if it's only 20 minutes) with judges
  - Designated "MATE liaison"
    - Could be MATE person or…
    - Someone you designate as "the" person to answer PR questions, collect waivers, administer surveys – could be a parent or "alumnus"

- Misc.
  - Robin's situation with China/Hong Kong and Macau

12:00 – 1:00pm: LUNCH

1:00 – 5:00pm: ITEST

- **Evaluation is fun!**
  - Year 2 results

- Survey tools, process, and MATE support
    - Suggested revisions to the process for next year
    - Translating surveys into Spanish

- Feedback on ITEST regional reporting form, including budget form

- Overview of Year 2 activities – what did we accomplish?

- Year 2 regional summary reports

    - Lessons learned and successful approaches
        - Monterey, SoCal, and NE – student mentors
        - PNW – mini-grants
        - NE and Oahu – community events/organizations as a way to get an "in" to schools
        - NE – creative ways to extend resources
        - Florida – "MATE" high schools as project partners
        - Great Lakes and Mid-Atlantic – leveraging existing resources and connections

- Year 3 regionals
    - Review of grant activities
    - Questions or concerns?

- Summer Institute
    - Implementing lessons learned in Year = success!
    - Recruitment for Year 3
        - We need your help with promoting and recruitment!

- Career component
    - New approach – pilot video project

- Updates on curriculum and ROVER

- Sustainability – the future of ITEST

6:15pm – Departure from the hotel – DINNER WITH THE GROUP

Passionfish (they have other items besides seafood!)
701 Lighthouse Ave, Pacific Grove, CA
(831) 655-3311
www.passionfish.net

Friday, November 11th

8:00am: Breakfast

Sweet (pastries, jams and jellies) as well as savory (eggs, potatoes) breakfast items will be available.

8:30am – 12:00pm: PLANS FOR NEXT YEAR

- **Continue any outstanding discussions from Thursday**

- **2012 competition overview**
  - Theme and partnerships
  - Location and tentative dates of the international
  - Continued "entrepreneurial approach," PR kit for teams/poster display requirements
    - Encouraged but optional team video – who to evaluate and what's the prize?

- **2012 competition missions**
  - Mission tasks, scoring, and props

- **Competition handbook**
  - Resurrected on Google Docs!

- **Future plans for Summer Institutes**
  - On-line courses and resources

- **SeaMATE 1.0**

- **Wrap-up and plans for next year's meeting**
  - Rides to the airport on Saturday

12:00 – 1:00pm: LUNCH

1:30 – 5:00pm: MBARI

- **Presentation – Farley Shane, Mechanical Engineer, MBARI**

- **Tours of the facility and underwater vehicles – Farley Shane and TBD**

DINNER ON YOUR OWN (save your receipts!)

MATE REGIONAL COORDINATORS MEETING
November 10 - 11, 2011
Monterey Peninsula College
Monterey, CA

Name	Affiliation	Regional
Jill Zande	MATE Center	
Deidre Sullivan	MATE Center	
Candiya Mann	Washington State University	
Matt Gardner	MATE Center	
Jeremy Hertzberg	MATE Center	Monterey
Erica Moulton	MATE Center	Florida
Sean Moody	MATE Center	Florida
Rick Rupan	University of Washington	Pacific Northwest
Cathy Sakas	Gray's Reef National Marine Sanctuary	Southeast
Jody Patterson	Gray's Reef National Marine Sanctuary	Southeast
Kim Morris-Zarneke	Georgia Aquarium	Southeast
Dwight Howse	Marine Institute/Memorial University	Newfoundland & Labrador
Lisa Spence	NASA	Texas
Karen Cohen	University of Houston	Texas
Zachary Cohen	University of Houston	Texas
Penny Pung	ITEST Administrator	Big Island
Scott Fraser	Long Beach City College	So-Cal
Meghan Abella-Bowen	Bristol Community College	New England
Velda Morris	Urban STEM Strategy Group	Pennsylvania
DeDee Ludwig	Shedd Aquarium	Midwest
Sarah Waters	Thunder Bay National Marine Sanctuary	Great Lakes
Sharon Gilman	Coastal Carolina University	Carolina
Caroline Joyce	University of Wisconsin-Milwaukee	Wisconsin
Graeme Dunbar	Robert Gordon University	Scotland
Garrett Clayton	Villanova University	Pennsylvania
Miranda Kerr	Shedd Aquarium	Midwest
Kim Swan	Monterey Bay Aquarium	Monterey