MATE ROV Competitions:
Providing Pathways to the Ocean STEM Workforce
Annual Report
July 1, 2010 through June 30, 2011

EXECUTIVE SUMMARY

About the MATE Center

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

Project Overview

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

Specifically, *MATE ROV Competitions: Providing Pathways to the Ocean STEM Workforce* expands the MATE Center's successful ROV competition program to middle schools. It uses MATE's existing regional competition network as the mechanism 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 with their ROV work and pursue STEM degree programs as they take advantage of opportunities at postsecondary institutions. Along the way, they can access information and resources to complement their learning and connect with like-minded students, teachers, and working professionals through the cyperlearning center.

ACTIVITIES IN YEAR 2

The activities in Year 2 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 2:

- Provide 80 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 800 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 2:

- Based upon information gathered on existing middle school career resources and from interviews with middle school teachers, begin to adapt, modify, and develop new career resources.
- 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 2:

- Continue to refine and expand 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 2:

- Refine evaluation protocols.

- Update post-competition surveys to be "scannable." Create post-competition survey for judges and volunteers.
- 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 2 evaluation report.

MAJOR ACCOMPLISHMENTS

Between July 1, 2010 and June 30, 2011 the MATE Center and its ITEST project partners:

- Offered 15 professional development workshops to more than 120 middle school teachers who serve underrepresented students. These workshops provided between 2 and 8 hours of professional development.
- Follow-up student workshops and other activities (such as presentations by industry professionals and classroom visits by college students and industry professionals) provided 90 of these middle school teachers with additional professional development, for a total of 20 or more hours; 60 teachers received more than 40 total hours.
- Offered one entry-level Summer Institute for Faculty Development that provided 3 Year 1 teachers with an additional 56 hours, for a total of 84 hours.
- In July of 2011, will offer a second entry-level Summer Institute for Faculty Development for 20 teachers. Eleven of these 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 more than 200 student workshops, classroom visits, outreach activities, or other hands-on opportunities that reached more than 1,900 middle school students. More than half of these students received at least 8 hours of instruction and hands-on STEM learning experiences. These activities also served as venues to deliver career information, which included "career profiles" presented by industry professionals.
    - Broader impact: The Pacific Northwest regional's "classroom visits" were often all-day events where information was presented to multiple classes and afterschool clubs of 20 students or more. While the intention was not to engage and support all of these students in carrying out ITEST ROV activities, through its school visits the Pacific Northwest impacted more than 400 students. Similarly, in Hawaii-Oahu, the majority of the outreach activities were community- or organization-wide events (e.g. the annual Boy Scout Makahiki gathering) that involved nearly 600 students.
- Engaged nearly 100 high school, 60+ community college, 25 university undergraduate, and 5 graduate students and nearly 200 industry professionals to support these activities.
- Continued to encourage parental involvement in the project activities and surveyed 130 parents about the changes they witnessed in their children as a result of the ROV program.

- Worked with the Shedd Aquarium to create a draft middle school ROV curriculum that was disseminated to Year 2 ITEST teachers and reviewed by content experts. Developed a partnership with Immersion Presents (see www.immersionlearning.org) to gain access to their curriculum resources and expertise. Feedback as well as photos and illustrations are currently being incorporated. The goal is to finalize the curriculum and disseminate it via workshops and on ROVER during Year 3.
- 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 8 of MATE's U.S.-based regionals.
- Based upon information gathered during Year 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.
- By September 2011, will have 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 200 new elementary, middle, and high schools that participated in the 2011 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.
- Launched the ROVER cyberlearning center in September 2010 and throughout Year 2 continued to refine and expand the site. ROVER hosted 100% of the participant portion of the 2011 MATE ROV competition season. This included serving as the portal for team registration. More than 2,100 students, mentors, and judges who took part in the 2011 competitions utilized ROVER to register their involvement.
- Refined evaluation protocols, 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.
- Held a regional coordinators' meeting that debriefed the 2010 competition season; presented plans for the 2011 competition; provided details about Year 1 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 2 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 more 60 conferences, meetings, community events, and other outreach activities, reaching thousands of educators, students, working professionals, and community members.
    - Broader impact: Developed a partnership with the Boy Scouts of America (BSA). In April of 2011, BSA announced its new Robotics Merit Badge. Underwater robotics, and specifically the MATE ROV competition, is included within the BSA's Merit Badge Series – Robotics booklet as a way that Scouts can achieve this badge.
- Published articles and information about MATE's ITEST project more than 30 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. The 4 regions that implemented activities in Year 1 used their "lessons learned" as well as brainstorming discussions from the 2010 coordinators' meeting to make improvements in their methods, delivery, and level and type of support. For example, in Monterey a partnership with the California State University's (CSUMB) Service Learning Institute lead to 1-2 mentors dedicated to each ITEST afterschool "classroom." This not only eased the workload of the project PI/regional coordinator, it also increased teachers' confidence in delivering the material and provided exemplary role models for the younger students (based personal communication with ITEST regional teachers).

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 year two 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.

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 discussed at the 2010 regional coordinators meeting and implemented with success in Year 2 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. The draft middle school curriculum allowed each region to better demonstrate to teachers, principals, and administrators the connection between science in the classroom/afterschool classroom and the ROV project.

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. Despite a late start, these two regions took significant steps to accomplish the grant activities.

Demographic data collected from six regions (Monterey, the Pacific Northwest, New England, Southern California, Florida, and the Great Lakes) show that half of the students were of minority background. Socioeconomic data revealed that 44% of the students came from high poverty areas. (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. All (100%) of the teachers responding to post-professional development workshop surveys rated the usefulness of the workshops as either good or excellent; the majority (95%) also felt that the training had addressed their concerns about mentoring students in designing and building ROVs. One hundred percent 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 60% 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, 91% of the respondents reported that they observed improvements in their students' STEM knowledge and skills. Nearly 100% 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 science, technology, engineering or math; 82% responded that participation in the program had made it easier to picture their child in a STEM career. Sixty percent (60%) of parents reported that their children were better able to work with others due to their involvement in the ROV project and that their child's self-confidence improved. Ninety-eight percent (98%) of the parents rated their children's experience building and competing with an ROV good or excellent.

As in Year 1, there were things that worked well and things that did not work well in each region. For example, in Florida what worked well was the experience of the regional coordinator, who is also a Co-PI on the grant. Her existing connections with area schools and technical expertise enabled her region to carry out teacher/student workshops and outreach despite a late start implementing grant activities. Given the reach into a primary Spanish-speaking school district, what emerged as a challenge in Monterey was the lack of competition waivers and surveys in Spanish; we plan to remedy this in Year 3. Three regions used ITEST to leverage additional sources of outside funding to support both their ITEST work and to engage high school teachers and students, building both capacity and the STEM educational pathway.

MATE and the Shedd Aquarium produced a draft curriculum that was disseminated to teachers participating in the 2010 Beginner Level Summer Institute and the Year 2 regional workshops, with the intention that it would be used to support implementation of the ROV project and participation in the competition. Feedback collected from these teachers, as well as from MATE staff and content experts, will be incorporated into "draft 2."

Several steps were taken to address the Year 1 challenge of recruiting middle school teachers from each region for the entry-level Summer Institute. For example, a letter addressed to school administrators describing the programs and its benefits was created and disseminated to teachers participating in regional support workshops. A Year 1 "highlights" page, packed with surveys results and quotes from teachers and parents, accompanied the letter. General information about the Institute was circulated earlier than last year; the first announcements were sent in September.

ROVER was launched in September 2010 with information, resources, communication forums, links to outside sources, social media outlets, and more. The MATE competition site (formerly housed at www.marinetech.org), including team registration tools, was migrated to ROVER. This move made the site the one-stop shop for 2011 competition information, communication, and participant support. Unfortunately, site statistics were not collected for the first 8 months. This error was corrected in mid June so data will be available for the Year 3 report.

Protocols and survey tools were refined based on lessons learned in Year 1. Several evaluation successes as well as challenges are noted above, described under Objective 4 below, and presented in detail within the evaluation report. The evaluation report is included with the Addenda.

DETAILED DESCRIPTIONS OF ACTIVITIES AND FINDINGS ORGANIZED BY OBJECTIVE

Detailed information on Year 2 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 three U.S-based and one foreign regional have been established, bringing the total number of MATE regional ROV competitions (U.S-based and foreign) to 20. 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, more than 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 will be 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.

While there were a number of similarities, each region took different approaches 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, and NEW ENGLAND

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

Based on lessons learned in Year 1, the Monterey region opted to sacrifice quantity for quality and continue to work with and support the Monterey Peninsula Unified School District (MPUSD) afterschool programs that were involved in Year 1. Otherwise, Jill was concerned that the program would not be sustained in these schools. Teachers/afterschool program coordinators from La Mesa Elementary, Los Arboles Middle School, Seaside Middle School, and Colton Middle School were invited to participate in the program again in Year 2. (Note: Over the summer of 2010, MPUSD combined King Middle School and Fitch Middle School into Seaside Middle School; the Year 1 instructor from King moved to Colton.)

Through the Monterey Bay Aquarium's Community Partnership Program, Jill continued to connect with teachers within the Pajaro Valley Unified School District (PVUSD). This included teachers of grades 5 and/or 6 from Ohlone, H.A. Hyde, and Radcliff Elementary Schools as well as the Coordinator of the Watsonville Environmental Science Workshop. The Workshop was established in 1997 as part of the California Community Science Workshop expansion made possible through an NSF grant. It is a community resource that provides afterschool as well as Saturday programs for PVUSD students and their families. The majority of students who participate in the program are Hispanic/Latino and ESL (English as a second language) learners. The Coordinator designated one of his staff and three high school students who volunteer at the workshop to participate in the program.

One important lesson learned from Year 1 was the need to increase the volunteer/mentor pool. To that end, Jill reached out to and formed a "community partnership" with the Service Learning Institute at CSUMB. As a result, five students enrolled in computer science and technology service learning courses requested to serve their 30+ hours of service learning as in-classroom mentors for the participating schools. (Note: These courses and the community hours are a graduation requirement for all students at CSUMB.) Jill also reached out to area high school and community college students; two Aptos High School Robotics team and two Hartnell College students stepped forward to join the pool of mentors.

In preparation for working within the schools, the MATE Center held an orientation for the 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 visiting the schools for at least 2 hours one to two days per week for eight weeks.

Based on feedback from teachers in Year 1, the professional development workshop was moved from the fall to January to put it closer to the timeframe when the teachers would actually implement the project. Nine teachers/afterschool coordinators representing eight schools participated. 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 professional development 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.

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, April 2nd, 2011. All total, 44 SCOUT teams participated. Of those 44, six were teams from the ITEST schools.

Since not all of the schools and students participated either as competitors or spectators during the contest, in May Jill and her colleagues arranged other, culminating events where the students could showcase their vehicles and receive recognition. The "MPUSD ROVER Night" was hosted by MAOS at Monterey High School while the "PVUSD ROV Event" was hosted by Aptos High School and held at Watsonville High School's pool. Nearly 40 students from six of the schools – along with their teachers, afterschool site coordinators, and parents – attended. The students had the opportunity to participate in a mini-competition and received certificates.

What Worked

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. Evidence that attests to this: none of the teachers took advantage of the open house wiring day at MPC. Having skilled mentors in the classroom provided the teachers with the help that they needed for that with the most difficult part of ROV construction. The increased mentor pool also allowed Jill to focus her time and energies on managing the Monterey region activities and serving as the PI of ITEST grant.

While the MATE Center provided each mentor with a small stipend based on the total number of hours they spent in the classroom, most of the student mentors reported that the academic credit and altruistic benefits they received from the experience far outweighed the monetary compensation. Letters from two CSUMB students provided in the Addenda speak to this.

While the majority of the mentors were white males, two were female and two were Hispanic/Latino. We recognize the importance of providing role models that "look like they do;'" however, the elementary and middle school students were still able to make connections. Comments included in the end-of-year report that the Ohlone Elementary teacher submitted to her district coordinator demonstrates this:

By far the best experience from this was working with our mentors, Connor Munger and Isaac Cassar. They were amazing with my students! They were respectful, helpful, personable, and my students loved them. Even on competition day they always stopped and focused on my students, no matter what they were doing. They even gave them a personal demonstration as to their own ROV, which was much more advanced than ours! When Ohlone heard the Aptos High team had taken the championship, it was like they won also. They were so proud that they were their mentors.

What Didn't Work and Lessons Learned

Again this year, schools were encouraged to hold their own internal "run-offs," with the top winning team(s) moving on to participate in the regional contest. This was done to alleviate the potential massive influx of teams into an already packed SCOUT class competition. However, given the short timeframe to prepare for the contest (the contest moved to April 2 because of a scheduling conflict with another community event), in some cases the teachers spent less than eight weeks on the project. While six of the schools did bring vehicles to the competition, those teachers said that they felt rushed; the vehicle was not in prime working order and the students did not have adequate time to practice and prepare their engineering presentations and poster displays. To address this, we will move the 2012 competition to May and be more conscious of the schedules of other events.

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 (CTE) Project Manager; Amy Smith is the CTE Coordinator. They work closely with Scott to make connections to local schools and support the grant activities. Marty Alvarado and Saren Rem, from the LBCC grant's office, oversee the financial aspects of the grant and contribute to the annual reporting of ITEST activities.

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. Connecting with area schools and getting buy-in from the teachers was a much easier process. LBUSD arranged for Scott to present information to interested teachers in November of 2010. 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. A copy of the presentation that includes the student successes in included within the Addenda.

Like Monterey, Southern California made the decision to continue to work with three of the schools that participated in Year 1. Each of these schools had 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 in these schools.

Two day-long professional development workshops were offered for 15 teachers from eight different schools: Hamilton Middle School (returning school), Lindsey Academy (returning school), Marshall Middle School, Robinson Academy, Washington Middle School (returning school), Lindbergh Middle School, Monroe K-8 School, and Henry K-8 School. The workshops were held at LBCC. 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 five new middle schools participating in Year 2. These students worked side-by-side with the teachers during the workshops. Back in the classrooms, the project was kicked off with a four-hour visit by Scott where the students were introduced to ROVs using the ROV kits provided by MATE.

From there, the teachers had an assortment of in-class and afterschool design and building sessions during. Most of the teachers held two or three afterschool sessions per week for an average of eight weeks. On Saturday, April 16th, an all-day pool practice session was offered to all teams. During the session, the teams worked with LBCC students to troubleshoot, modify, and learn how to fly their vehicles. The schools used this session as a "run-off" to select the top two ROVs/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 7th. All total, 18 SCOUT class teams participated. 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.

What Worked
Like last year, 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.

It was evident that the teachers themselves gained confidence in delivering and facilitating STEM learning experiences. Teachers were observed challenging their students to troubleshoot and develop solutions to technical problems on their own.

Students also gained confidence in their abilities and working as part of a team. For example, at the practice session, a team of girls quickly became competent piloting their ROV to complete the mission tasks. When they noticed a team of boys nearby struggling with their ROV, they jumped in to provide guidance and direction with a confident, "this is how you do it." After a few minutes, the boys were able to complete the tasks by themselves.

What Didn't Work and Lessons Learned
LBUSD district-wide layoffs affected three middle school participants, cutting their involvement short. Of the eight original schools, one withdrew after the practice session. Sustainability is still seen as a challenge, both in providing and expanding the ITEST activities and incorporating the model into integrated lesson plans district-wide.

Having identified those challenges, the Southern California region (as well as the entire regional ITEST network!) will continue to work to address them in Year 3. Progress has already begun. After presenting information about the ITEST grant and activities at an LBCC/LBUSD Expanding Pathways Committee meeting in June, several K-12 participants expressed a desire to learn more about the ITEST model and develop STEM pathways into robotics and marine career fields. This dialogue will be continued as a way to build upon the ITEST work and sustain it – as well as other innovative STEM activities – in the future.

Also, particular attention needs to be paid at each individual school so that assigned kits, including tools and supplies, are maintained and stored for use in future years. Another potential challenge/opportunity in future years will be to work with a new project leader from LBUSD. The current leader has been promoted to a principal position.

PACIFIC NORTHWEST
The Pacific Northwest (PNW) Regional ROV Challenge is organized and operated by the Marine Technology Society (MTS) Puget Sound Section. Fritz Stahr and Rick Rupan were joined by Wes Thompson as the leads on the Challenge as well as on the region's ITEST grant activities. Fritz is the current Chair and Rick is the Outreach Coordinator for the MTS Puget Sound Section; all three are marine technical professionals at the University of Washington (UW). This year they hired Lyle Smith, a recent graduate of Arizona State University in electrical engineering, to help with ROV kit maintenance and distribution as well as to serve as a mentor for those teachers and students who needed technical help. The MTS-Puget Sound Section is the fiscal agent for the grant funds.

This was the second year of implementing the ITEST grant within the Pacific Northwest region. Fritz, Rick and Wes started teacher recruitment in a similar fashion as last year – by distributing a flyer that described the opportunity in electronic and hard-copy form directly to school districts as well as through both the Puget Sound Section email list and prior participants. Like last year, the number of responses was limited; however, those teachers who did reply were a motivated and enthusiastic group. Several teachers ended up taking the whole experience to a much broader audience of teachers and students within their home districts (e.g., Gig Harbor and Port Townsend).

Using lessons learned in Year 1, Fritz, Rick, and Wes modified their professional development

workshop, which was held in December, to get the teachers through the slowest parts (learning to solder and complete the wire assemblies) without the time pressure. Doing that meant that the teachers were able to take home much more completed, functional ROVs than last year, which build their confidence significantly. In addition, the teachers took home the draft of the curriculum being developed through ITEST. They very much appreciated that and felt comfortable having a more significant reference to real teaching modules in hand.

Follow-up visits to the teachers' schools by Fritz, Rick, Wes, or other marine technology professionals occurred over the following four months starting in January and continuing through April. As last year, some visits were day-long and school-wide (or at least multiple classrooms) affairs, while others were just with the school's robotics club. Rick and Fritz attended a district-wide robotics competition in Gig Harbor that included ROVs that students built. During the event, Fritz delivered a presentation about the Seaglider, the autonomous underwater vehicle (AUV) that he works with. While there, they encountered many more teachers and parents who had heard about the MATE ROV Regional Challenge, mainly because of the success of last year's program.

Like last year, Fritz, Rick, and Wes used a system of mini-grants to assist those schools that demonstrated a need to acquire tools and kits to build ROVs. One teacher from Year 1 who was unable to put together an ROV team took advantage of the mini-grant system to implement the program successfully this year after modifying his schedule to accommodate the project. The kits and tools provided by the mini-grants are primarily funded from the salary portion of the region's ITEST funds, as all three of the leads donate their time to the program.

The full-day ROV-wiring workshop held in March was equally as well attended as last year; Fritz, Rick, and Wes even had to limit the participating schools to no more than three students and one mentor in order to fit accommodate all of those who were interested. Like last year, the workshop touched many parents; all of those who attended came away with an important understanding of the skills their children were learning through this program. Often it is these interactions with parents that are truly illuminating to the power of this program. One said that this activity was what kept their child interested in going to school.

The region's third set of "workshops" were actually four half-days where the student teams could practice and fine-tune their ROVs in the test tank at UW's School of Oceanography. These practice days, which took place in April, were supervised by one of the three ITEST leads and attended by many teams. During this time, there was even more interaction with parents who accompanied their children.

Again this year, the culminating event was the SCOUT class competition held on May 7 as part of the MATE PNW Regional ROV Challenge. Based on lessons learned, new schools and clubs were limited to a maximum of two teams each, while returning Year 1 schools were limited to one team each until a cut-off date of April 1. More than 24 teams registered, which meant that some were put onto a waiting list; at least one team on the waiting list made it to the event due to a last-minute drop-out from one of the new schools.

Overall, 24 teams representing 15 different schools and clubs competed. The event engaged more than 65 volunteers (the majority being marine technology professionals), who served as judges and technical support. The interaction between these volunteers and the students was wonderful to watch. A number of lessons learned from last year's experience about managing growth and crowd control were implemented and, for the most part, worked as planned. This success gives Fritz, Rick, and Wes confidence going forward that they can handle the increased interest for many years into the future.

As a follow on, one of the connections made during the event between a teacher and a marine technology company resulted in additional technology experiences for her student teams. The month following the competition, engineers from the company were doing work with a manned

submersible and ROVs in her hometown and invited her students to participate. Without a venue like the competition, that type of connection is otherwise hard to make.

What Worked
Like last year, the partnerships already in place in the Seattle area between MTS-Puget Sound, UW, and many marine technology companies played a key role in carrying out the grant activities. Expanding the program was certainly easier after the first year in terms of both experience and in providing examples to newly interested teachers, parents, and students. Further, the new Director of the UW School of Oceanography (Dr. Virginia Armbrust) provided quite a bit of recognition and support of the program both at faculty meetings and during a surprise personal visit to the ROV Challenge. This sort of "top-down" support is always appreciated and helps to sustain energy and enthusiasm. Having Lyle available as a technical troubleshooter for the teachers and students (and to relieve Fritz, Rick, and Wes of some of these duties) was also extremely helpful.

The mini-grant system continues to be effective in spurring student activity because it provides the basic building blocks, but no fixed design "blue-print," and allows all of the creative experimentation that is a key to student learning. Further, the mini-grants have the potential to serve as the seed for schools/school districts to create their own programs, as was the case with at least two of the districts. This broader impact then spreads the STEM learning experience to thousands of students each year.

Finally, parents' involvement is the key to so much of their children's success. If parents feel welcomed and supported, they will in turn lend their support to the school, at home, and to the program. The region's ITEST leads put forward a great effort to make sure that parents felt valued and engaged, particularly when it came to welcoming their time and talents if they were able and willing to donate them to support the program.

What Didn't Work and Lessons Learned
There are still some issues to work out in respect to various components of the regional contest, One issue is accurate and consistent score keeping, but the coordinators have ideas on how to implement a system to address that.

Another challenge is actually an opportunity. The 10 original ROV kits are getting much more use by teachers who request to borrow them for special events – events that are designed to engage even more teachers, students, and parents. For example, the kits have been used at community-wide and school-specific events in Oregon and in at least four different places in Washington. This increased use results in much more wear and tear, which increases the need for maintenance and replacement parts. However, the ability to get more teachers, students, and parents enthused about this sort of technology and experiential teaching far outweighs the cost and effort.

Participation by minority and low-income students is still low, but significantly better than last year. In addition to Rick, Lyle is of minority (Native American) background, which helped somewhat in offering minority students a vision of themselves in the future. Fritz's Center for Ocean Sciences Education Excellence (COSEE) colleagues research that particular situation (i.e., mentoring of minorities), so he realizes how important examples are for those students. To that end, the ITEST leads will continue to work to expand their reach into those communities as well as to engage appropriate role models for these students.

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. This year the Boys and Girls Club of Fall River and New Bedford High School provided access to facilities.

Teacher recruitment was similar to Year 1, but with some notable improvements based on lessons learned. First, recruitment began much earlier. In July of 2010, Meghan and BCC ROV and Engineering Technology students hosted an information booth, complete with assembled ROV kits and a test tank, at the Southeastern Massachusetts Connect Summer of Science Event. The Connect event was designed to highlight STEM programs available to the region through the five state and community colleges located in southeastern Massachusetts.

In August, Meghan and her partners offered two basic ROV design and building workshops, which were hosted by local Boys and Girls Club. One parent (and local middle school teacher) who learned about the ROV workshops from the Connect event and four of her students attended one of the workshops. In September, Meghan hosted a BCC/ITEST/ROV booth at the New Bedford Working Waterfront Festival to promote ROV activities and her upcoming teacher professional development workshops. Finally, in October, Meghan and Sue presented information about ITEST and the professional development workshops at the Southeast Massachusetts Robotics conference.

Through the community-wide events, Meghan was able to market the ROV and ITEST activities directly to students and parents. These parents and students were then encouraged to talk to their teachers and/or afterschool program professionals about becoming involved. The result was one new teacher and four afterschool providers taking part in the professional development workshop. Through the Southeast Massachusetts Robotics Conference, Meghan was able to market directly to teachers in the region who were already interested in integrating a robotics component into their program. Participation in this conference resulted in the recruitment of two new teachers from a high school not originally in target region. This high school draws from the Brockton region, which, like Fall River and New Bedford, is a city with higher than average unemployment rates, large minority (ESL) communities, and high dropout rates in comparison to the state as a whole.

In addition to the extensive outreach done throughout the summer and fall, traditional outreach methods were used to recruit teachers and afterschool personnel to the program. For example, advertising and recruitment began approximately 6-8 weeks prior to a workshop. In Year 1 an email list of middle school teachers and department heads in STEM was compiled for the cities they were targeting (Fall River, New Bedford, Taunton, and Attleboro). This list was updated and expanded in the fall of 2010 to include new school districts and contacts for teachers who participated in 2010 summer and fall ROV outreach activities.

In addition to recruiting early, Meghan and her colleagues expanded their efforts to include youth serving organizations, such as the Boys and Girls Clubs, YMCAs, and the Citizen Schools program in New Bedford. The ROV outreach workshops held at both the Fall River and Taunton Boys and Girls Clubs generated considerable interest in the teacher professional development

workshops. As a result, four local Boys and Girls clubs sent personnel and/or college student volunteers to a professional development workshop.

The two ROV professional development workshops offered in Year 2 took place at BCC. The first workshop was held on Saturday, November 6th, 2010 and provided the teachers with a basic overview of how to design and build an ROV. All participants built an ROV that they were able to take back to their school or afterschool program and use as a recruitment tool to engage students. The second workshop offered on Saturday, February 5th, 2011 focused on building a control box as well as a presentation from a middle school teacher who had integrated the ROV project into his classroom and tied the project to the Massachusetts technology frameworks. As a result of these workshops, two new middle school teachers (Henry Lord in Fall River and Wareham Middle School) implemented ROV programs at their schools.

Once the teachers and afterschool professionals were trained and engaged, they took the lead role in identifying and recruiting students for their ROV teams, and afterschool programs. As a result, 130 middle school students participated in some type of ROV activity. Of those 130 students, 54 participated on ROV teams.

One middle school teacher in particular needs highlighting. Keith Bradley teaches marine science at Henry Lord Middle School, a low performing school in Fall River. After participating in the November workshop, Keith designed a four-week module that focused on ROVs and various scientific techniques and integrated it into each of his five marine science courses, which all total serve 68 students. Rhonda Moniz, an ROV pilot and owner of Benthic Exploration, kicked off the module with a presentation about ROVs and the work she's involved with. For the next two weeks, the module focused on ROV design and basic concepts, such as buoyancy and center of gravity. During the final two weeks of the module, BCC ROV team members worked in the classroom as mentors to provided one-on-one design and building support.

In order to engage all of his students, Keith realized that he would need resources for 25 ROVs. (Note that in responses to professional development surveys, "access to resources" was identified as a major reason for not integrating the ROV project into the classroom.) Several other schools asked for similar support. At first, Meghan was unsure if she would be able to accommodate these requests. Then she and her colleagues came up with a solution that they feel worked. Using the non-soldering control box design and quick connects for the motors as well as the PVC pipe connectors from the ROV kits provided by MATE, they were able to provide Keith and the other schools with supplies that could then be unassembled and reused. Although some prep work (completed by the BCC ROV team) was required in order to keep cost in check and ensure that resources such as wire, control boxes, and motors were not wasted using this approach they were able to create 30 ROV packages that could be loaned to a school or program then returned after completion of the project.

After finishing the ROV module, Keith recruited eight students who joined his afterschool program and designed and built ROVs to take part in the SCOUT class competition. This same model and ROV parts "solution" was used with Wareham Middle School to engage 23 students. Thirteen students from that group were then recruited to participate in the competition.

This year the SCOUT class competition was held in conjunction with the New England Regional ROV Contest on April 23rd, 2011 at MMA. Fifty-four students on eight teams representing five schools/organizations participated in the SCOUT class. Originally, 12 teams were registered to compete; however, due to various issues four teams dropped out a week before the event. Three of those teams (from Normandin Middle School) were able to compete in a mini-ROV competition, which Meghan organized, on May 5th.

What Worked

The New England ITEST project relies heavily on the volunteer support of students from BCC, UMass-Dartmouth, and MMA. These students are instrumental in providing technical support to

the ITEST project. 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 support the program. For the UMass-Dartmouth students specifically, the ROV team (which includes three former BCC team members) was looking for ways to demonstrate community involvement to its student senate.

Using community-wide events and festivals to engage parents and students who, in turn, engaged their teachers was an indirect way to make inroads into the schools. That approach, coupled with developing partnerships with youth-serving organizations such and the Boys and Girls Club, made recruiting in Year 2 much easier and more successful. Having a middle school teacher like Keith who acted as an advocate and cheerleader for the program, especially as an in-school activity (versus afterschool program) tied to curriculum frameworks, was also extremely helpful and a key to convincing schools to become involved. (A PowerPoint presentation describing Keith's curriculum module is included within the Addenda.)

Being creative in how they provided ROV supplies to the schools allowed Meghan and the New England region to engage and support even more teachers and students. The materials "loaner" program was a unique way to extend the grant resources.

What Didn't Work and Lessons Learned

Year 2's experience can be summarized by three lessons learned. First, direct and regular communications with partner organizations is important, especially if college student volunteers are acting as the intermediary. For example, although Meghan had communicated to the student mentors that the grant could pay for a bus to transport the ROV teams and their parents to the competition, the information was not effectively communicated to school personnel. As a result, two days before the competition, the school made a decision to withdraw due to lack of funds for transportation. By the time Meghan was informed of the issue, it was too late to resolve the problem. Next year, she will check in with partner organizers regularly via email or phone to ensure all parties are aware of issues and concerns as soon as they arise.

Second, check in with the teachers/mentors and ROV teams on a regular basis. On several occasions, Meghan learned that an ROV team was struggling with a resource issue (be it lack of funds or where to purchase necessary equipment). For first-time teams, this can feel like a very big hurdle and may be the reason a teacher or program chooses to not become involved. Developing a communication system that lets schools know that there will be support and being proactive, especially in the beginning, so that partners feel comfortable requesting information and support are important lessons learned. Past teachers who have benefited from this involvement may be the best qualified to market the support network.

Finally, recruit and train college or high school students to serve as mentors. Many students are looking for ways to become involved to meet civic engagement and or community service requirements required by their school. Similar to what was learned and implemented in Monterey, train these student mentors not only on the technical aspects of the program, but also on how to work and interactive with younger students. Don't assume that all college students understand how to manage a classroom environment or an awkward or inappropriate situation.

NEW ITEST REGIONS: MID-ATLANTIC, OAHU, FLORIDA, AND GREAT LAKES

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 provided him with a teacher and student base to recruit from when it came time to implement ITEST activities. Throughout the late summer and early fall of 2010, Peter presented at student events and teacher workshops specifically about the SCOUT class ROV project.

During the summer, to give visitors to Nauticus a simplified building experience, Peter created an ROV lab complete with a large water tank and individual work stations outfitted with PVC pipe and motor/controller units. This lab was particularly appealing to families, as it allowed them to work together to build and fly a basic ROV. More than that, it allowed teachers visiting with their families to get an idea of what the program could offer them during the school year.

The first event that resulted in a wealth of teacher/student interest was the annual "Scuba Jam for Scouts," which was held at Lake Rawlings near Emporia, VA Labor Day weekend. In addition to both boy and girl scouts, a number of local middle and high school teachers participated. Peter provided basic instruction then allowed the students and teachers to assemble and fly the ROV kits provided by MATE. Piloting the ROVs in the same lake where the students were diving was very exciting for the students in particular. Through the Scuba Jam, Peter recruited two teachers and 80 students from Granby High School in Norfolk, VA to participate in the ROV project.

In October, Peter presented to approximately 30 middle and high school teachers at the annual Cooperating Hampton Roads Organization for Minorities in Engineering (CHROME) Club sponsor launch. 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 Landstown Middle School in Virginia Beach, VA, stepped forward to participate in the project.

Also in October, Peter presented at Madison Alternative School in Norfolk, VA. The school serves students who have been expelled from their home schools due to discipline issues. As a result of his presentation, several students expressed an interest in designing and building ROVs.

Starting in November, Peter began in-classroom visits with students and teachers at both Landstown Middle School and Madison Alternative School. On a bi-weekly basis, he attended their afterschool programs to deliver supplies and assist the students with their ROVs. In March of 2011, he also began visiting Granby High school on a weekly basis to check on their progress.

At Landstown Middle School, Peter worked with a group of 15 students and their teacher through April of 2011, when they held their final CHROME Club meeting of the year. Knowing that the students would not participate in the actual regional SCOUT class competition, he 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. Peter plans to continue to work with the Club during Year 3 and is confident that they will participate in the 2012 SCOUT competition.

At Madison Alternative School, what started out as a group of five students winnowed down to one. This actually worked to both Peter's and the student's advantage. Peter was able to devote all of his efforts to helping this student develop and build technical, critical thinking, and problem solving skills. Given the unique situation, both the one-on-one time and the skills were especially beneficial to the student. With Peter's help, he built a functional ROV that he was able to test in the harbor in front of Nauticus. A media crew from Norfolk Public Schools (WNPS-TV) was there to document the event and the progress that Peter had made with this student. While this student did not participate in the SCOUT class competition, he was able to use the project to improve his record and return to his home school sooner than expected.

Granby High School offered a unique opportunity. Even though these were high school students, they were still very much at the entry-level of ROV design and building. After Peter's initial meeting with the school, the teacher proposed adding the ROV project to his end-of-the-year curriculum. The teacher recruited students from his tech-draw and engineering classes as well

as students from the electronics classes. The engineering students were in charge of constructing the frame and all of the "moving parts," while the electronics students were responsible for the cameras, motors, switches, and wiring. All of the students were graded on the project. In the end, 10 teams representing approximately 80 students participated in the SCOUT class at the regional competition. As a result of the experience and Peter's support, a number of these student teams may move up to the RANGER class next year.

The SCOUT class competition was held along with the RANGER class at the Mid-Atlantic Regional ROV Building Competition on May 21st, 2011. In addition to the teams from Granby High School, teams from Boy Scout Troop 2540 from Cape Henlopen, DE participated. All of these teams were competing for the first time and were impressed with the level at which the RANGER class teams were performing. Seeing the more advanced vehicles and interacting with the more experienced students were great experiences – and great motivators for these students to build upon their knowledge and skills in order to advance to that level.

What Worked

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 school and public educational programs.

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, including setting times and dates for their programs to start, was a challenge. Many more teachers expressed interest than actually participated. Also, although they were taught how to work with the ROV components, the teachers lacked the confidence to lead the students through designing and building the ROVs when Peter was not present to mentor and guide them.

The lesson from this is the need to increase the pool of volunteers who can provide mentoring and technical support within the classrooms. To that end, Peter will be working with Old Dominion University and other local colleges to find and recruit this assistance. Having additional volunteers to support the program will also allow Peter to expand his reach into other area schools/school districts.

HAWAII-OAHU

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. Timmie's move from Louisiana to Hawaii could not have come at a better time for both herself and the MATE Center. Her enthusiasm, passion for teaching, energy, and technical expertise (which increased exponentially after attending the Summer Institute) was exactly what was needed to support herself (she was hired by MATE) and ITEST activities on Oahu. The university and the MATE Center are the fiscal agents for the grant funds.

"Breaking in" to the Oahu region was initially very difficult. It was late in the school year

(March/April) and the schools themselves showed little interest in planning for the next school year, much less trying to fit a new program into the current year.

Given the minimal success Timmie had directly connecting with schools, she took an alternative route. Like Meghan and the New England region, she decided that working through the students themselves, getting them excited (and getting their parents excited) was the best way into the schools. Her initial contact was with the Boy and Girl Scouts of Hawaii. She provided professional development and technical assistance to their STEM program coordinators. These efforts culminated with a 10-hour ROV-in-a-bag event through the Boy Scouts "Makahiki" gathering at a large and active community park in Honolulu.

The event was a huge success. Students were engaged, parents were engaged, and MATE brochures and Timmie's business card were handed out in the hundreds. As a result, connections were made with schools and local educational venues.

From there, Timmie reached out to Hawaii Pacific University's Oceanic Institute and Sea Life Park, which are located on the same property). Fortunately, both were very interested in establishing a partnership. Through these organizations, Timmie was able to further coordinate with Kama'aina Kids (the state's largest afterschool care provider) for a series of summer events held at Sea Life Park. The summer program will culminate in August with a SCOUT class event held in Sea Life Park's reef tank that is expected to involve students from 20+ schools. In addition, the activities will be videostreamed live in order to reach even further into the community.

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's 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 (in some cases insisted!) that they get involved.

As a result, Timmie's phone hasn't stopped ringing. She is officially "the robot lady." On more than one occasion, she's been approached by both excited students who have asked for more details about the program and excited parents who are eager to participate. As a result of Timmie's outreach, community organizations (local automotive, hardware and public venues) are offering to help. Further, the PI connected Timmie with Hawaii's Robotics Organizing Committee (ROC), which was created and is run by the governor's office (see www.hawaiiroc.org). ROC personnel will participate – and support – the SCOUT class culmination event planned for August.

To accommodate the growing interest, Timmie is organizing a week-long workshop for area teachers that will be held at the Oceanic Institute this coming October. The MATE Center is supporting the workshop by sending staff and materials; ROC is funding the materials and teacher participation (meals, etc.). It is fully expected that in Year 3, Oahu will boast a very healthy and thriving SCOUT class program in elementary (grades 5 and up) and middle schools as well as in afterschool programs and community groups.

What Didn't Work and Lessons Learned

Trying to connect directly with the schools through phone calls and e-mails to school administrators and the district offices proved exhausting and exasperating. Further, trying to "sell" a program to teachers who are accustomed to having strings and complications with "out of the box" education programs was difficult. It wasn't until Timmie "worked the system backwards" and made inroads with organizations such as the Boy Scouts that the door was opened. Now the challenge is accommodating the interest – but there are plans in place for how to do that (see "what worked" above).

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

Originally scheduled to implement ITEST activities in Year 3, the Florida region was asked to step up to Year 2 late in the grant year. However, despite a late start, Erica's existing partnerships, rapport with area teachers, and technical expertise allowed her to make significant progress.

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. Erica also made contact with the county school system science supervisor, Julie Poth. Familiar with MATE and the ROV program, Julie granted permission to incorporate the program into the Pinellas County schools. In addition, she recommended schools that were already on the target list, namely Campbell Park and Madeira Beach Middle Schools.

Most teachers were interested in participating, but finding leave time and/or the time to participate was elusive at best. At Campbell Park and Madeira Beach (and later the YMCA) there was a high level of interest, but in each case a date or dates to complete the professional development training could not be accommodated.

Recruiting students, in terms of interest in ROVs and the competition, was much easier. Several teachers and informal educators allowed access to their students for ROV demonstrations. Both Campbell Park School and the McClin public pool provided their facilities for basic ROV design and building ("ROV-in-a-bag") activities for four teachers and each and every 5th grader during Ocean Science Week.

Madison Middle School in Tampa provided three opportunities to reach out to their grade 7 and 8 science students. During the first visit, Erica, and an undergraduate student from USF who she hired as an intern, talked about ROVs, design and building, and the MATE ROV competition. In visit two, Erica and her intern lead the students through the design, assembly, and testing of the ROV kits. Visit three occurred during the Hillsborough County Magnet Recruitment Day, which was a great opportunity to promote the program to other area students. The Madison Middle School students flew their ROVs in a "kiddie" pool that Erica provided and allowed the students visiting the school to pilot them as well.

In addition to working within the school system, Erica made contact with Associated Marine Institutes (AMI), the YMCA of Greater St. Petersburg, and the Sarasota County STEM program. Each organization invited Erica to visit their facilities where she demonstrated the ROV kits to the managerial/administrative staff and provided them with information about the ROV project that included upcoming professional development opportunities, the materials that their teachers would receive, and the desired outcome – participation in a SCOUT class demonstration or competition event.

None of these contacts or in-person visits resulted in a commitment to participate this year, but the interest was high and all would like to be involved in Year 3. However, contact with Campbell Park Middle School did lead to organizers of the St. Petersburg Science and Engineering Festival. Erica participated by hosting a booth and allowing visitors to fly assembled ROV kits in a kiddie pool.

During the 7th annual Florida regional ROV contest on April 9th, Erica spoke with Riviera Beach Maritime Academy (RBMA) instructors David Sellpack and George Bradbury about the

challenges she was facing to incorporate the ROV program into new schools. David offered to speak to the science supervisor in his area (located on Florida's east coast) and encourage him to facilitate contacts with his middle school teachers. As a result, five teachers from David's school district signed up for professional development training.

A week later, an all-day workshop was hosted by David and George at RBMA. Mr. Moody and Ms. Moulton conducted the training in Riviera Beach. During the workshop, the participants built an ROV and were provided with a tool bag, tools, and power supply as well as materials to build five ROVs with their students back in their classrooms. Each teacher was charged with working with his or her students to create at least one SCOUT-level ROV to demonstrate at the SCOUT ROV Challenge scheduled for May 7th, which was just three weeks from the workshop.

All five teachers met the challenge and returned to the RBMA pool with students and functional ROVs on May 7th. All total, there were eight teams that represented students from various (6-8) grade levels (three of the teachers fielded two teams).

What Worked

Erica's existing partnerships, expertise, and intimacy with the ROV program and ITEST grant allowed her to hit the ground running. Finding a teacher already familiar with MATE's ROV program to help promote and advocate to other teachers was also essential. Erica tried meeting personally with a number of new organizations, but the key to success came from David's involvement within his school system and surrounding community.

In addition, George offered access to housing to any teacher and/or students participating in the workshop and/or Challenge event. Given that funds for accommodations could have been a barrier to participation, this was greatly appreciated.

What Didn't Work and Lessons Learned

The most challenging aspect was the need to acquire the necessary permissions to incorporate the program. Teachers need leave time or substitute teachers to cover their classrooms. In addition, they need proof that the program can be incorporated into their curriculum. A number of these issues can be resolved if there is buy-in from their administrators.

Erica's plan in Year 3 is to reintroduce the program to the Year 2 schools so that she can conduct a full training session with those teachers. Given the success that resulted from David's participation, Erica will reach out to other current MATE ROV schools to ask for assistance in connecting to middle schools in their area.

Having an "example" teacher nearby who has already overcome the barriers to participation within that school district is a great resource. For example, Melissa Fernandez is a "MATE teacher" at the Marine Academy of Science and Technology (MAST) in Miami, FL. Working with Melissa to reach out to and engage area teachers is beneficial to her school as well; it helps MAST to connect with potential future students, especially since ROVs are often viewed as a highly desirable "attractor" program.

GREAT LAKES

The Great Lake Regional ROV Contest is coordinated by the Thunder Bay National Marine Sanctuary 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. The Thunder Bay National Marine Sanctuary Foundation is the fiscal agent for the grant funds.

Originally scheduled to implement ITEST activities in Year 3, the Great Lakes region was asked to step up to Year 2 late in the grant year. As a result, Sarah and her partners did not have adequate time and resources to fully implement the grant activities. However, despite this, the region still made progress.

For example, the Sanctuary used existing relationships and outreach events to recruit participants from rural and socioeconomically disadvantaged areas. Through a community-based/place-based learning initiative called the "Great Lakes Stewardship Initiative," Sarah and her colleagues were already working with a 5th grade teacher to design and build ROVs in the classroom and use them to explore the local watershed. With ITEST support, they expanded that relationship and worked with this teacher to develop two SCOUT and two RANGER class competition teams.

Another existing relationship was with a 5th grade teacher at Bingham Arts Academy, a local charter school. The region used some of its ITEST travel funds to send this teacher and two other informal educators to a professional development workshop in Traverse City, Michigan in the fall of 2010. The workshop was coordinated by Keith Fortan, a teacher at Traverse City Central Senior High School who's been guiding his students through ROV projects and participating in the MATE competition for 6+ years. Sarah followed up with the Bingham Arts Academy teacher and supported him with materials, pool practice time, and personal visits to prepare an afterschool team for the regional SCOUT class competition.

In March of 2011, Sarah and the Sanctuary organized a professional development workshop that they advertised through their existing teacher contacts, a tri-county Educational Service District, and the Great Lakes Stewardship Initiative. They also displayed announcements around the community. The workshop was attended by two teachers (community college and high school) and five informal educators. Two additional teachers (middle and elementary school) that had been recruited for the workshop did not show up.

In addition to recruiting students and teachers for the MATE ROV competition throughout the year by setting out take-away materials in the Sanctuary public visitor center (the center receives approx. 60,000 visitors per year), Sarah and her colleagues held a number of outreach events to recruit participants as well as volunteers. Two four-hour basic ROV design and building outreach sessions were held at the Alpena County Plaza Pool – one in March and the other in April. These sessions were open to the public and advertised in the local paper and by posters in the community as well as through the network of the Alpena Community College Association of Lifelong Learners. During these sessions, information about how to form a team, what the MATE ROV competitions are all about, and marine career opportunities was presented. ROV teams that had already registered for the 2011 Great Lakes regional competition were invited to practice on the competition tasks and asked to talk about their vehicles to the visiting public.

Sarah also appeared on a local Sunday morning television program, "Talk of the Town" to promote the regional competition and to recruit participants. The eight-minute segment aired in April. In May, Sarah was able to use a Sanctuary outreach and education project, "Project Shiphunt," to connect with Saginaw area high school students, teachers, and school district administrators and promote the project in their area.

In June, Sarah presented at the Great Lakes Stewardship Initiative Annual Workshop to promote the ROV project and competition. The workshop was attended by teachers from a six-county area around Alpena.

Finally, again this year, the Sanctuary was able to partner with Michigan SeaGrant and the North Carolina Coastal Studies Institute to capture footage of the students both preparing for the competition and using their ROVs to perform fieldwork after the event. This footage will be used to make outreach products featuring ROV building and student teams in Northeast Michigan.

In preparation for next year, Sarah initiated initial meetings with Michigan's Girl Scouts' "Shore to Shore" staff as well as the head of Michigan's 4H programming to discuss ROV workshops for informal educators within their organizations. This should result in a healthy pool of teachers and students participating in the ITEST activities in Year 3.

What Worked
The Sanctuary's existing partnerships and outreach events played key roles in disseminating information about the ITEST activities and competition and recruiting participants.

In addition, providing Sanctuary education and outreach staff with professional development allowed them to develop both the skills and the confidence to guide teachers and students through the process. Sarah is planning to expand upon her own knowledge and skills by attending the MATE beginner-level Summer Institute in July.

What Didn't Work and Lessons Learned
Coming on board late in the year definitely didn't work! The lesson learned is to provide funds and other resources (such as the MATE ROV kits) as early in the "season" as possible. This will be remedied in Year 3.

SUMMARY OF DEMOGRAPHIC AND IMPACT INFORMATION
According to the demographic data collected via surveys (N=267), the students were about two-thirds male (65%), half (50%) were of minority backgrounds, 44% came from high poverty areas, and 5% reported that they had disabilities requiring accommodations. (See the evaluation report included with the Addenda for specific details and more information.)

One hundred percent of the teachers responding to post-professional development workshop surveys rated the usefulness of the workshops as either good or excellent. Ninety-eight percent (98%) said that they felt very or somewhat comfortable facilitating STEM learning experiences for their students after the training, and 95% indicated that the training had addressed their concerns about mentoring students in designing and building ROVs. One hundred percent 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 60% of the students stated that their ROV project made them more interested in a marine career. Sixty-six percent of the students indicated that their ROV project made them want to learn more about ocean STEM.

Among the teachers/mentors who completed post-competition surveys, 91% of the respondents reported that they observed improvements in their students' STEM knowledge and skills. Ninety-five percent of the teachers/mentors mentioned that they observed increases in their students' skills in team building, problem solving, and/or critical thinking. Comments included on the surveys further emphasize the benefits teachers felt that the project provided to their students:

Wow what amazing experience for all my students. Phenomenal benefits for them included skill building in every aspect of their education - science, engineering, interpersonal skills, meeting deadlines, cost analysis, team work, construction, electrical wiring, research, communication, presentation skills - verbal and visual, journaling, empathy, thinking about their futures and the environment… and more.

This program provides clear, exciting, and achievable goals that really engaged our team. Also, the competition emphasizes writing skills, which really motivated our team. The combination of hands on and research are great.

I've been so happy to see my students excited to spend more time at school. They were very proud of their designs and look forward to doing it again next year.

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; 82% responded that participation

in the program had made it easier to picture their child in a STEM career. Sixty percent of parents reported that their children were better able to work with others due to their involvement and that their child's self-confidence improved. Ninety-eight 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, 65% indicated that it was extremely valuable while 33% 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:

A higher determination to expand his knowledge and see through it until completion of project

Better at meeting deadlines

Better leadership skills, learned how to use technology (email, conf. calling, texting) to be productive (as opposed to just for fun)

More actively participating and contributing ideas and what she can do

More patience, improved problem solving skills

Thinking more about future careers

Results of pre- and post- teacher workshop surveys, post-competition student surveys, and parent surveys are presented and discussed in greater detail within the evaluation report (see 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 (a marked improvement over the PDF of existing materials provided last year); samples of workshop agendas, competition scoring templates; and guidance and feedback, as needed, via individual phone calls, conference calls, webinars, and e-mails on both a scheduled and an as-needed basis. We also provided them with ROV kits as well as technical and logistical (i.e., ordering materials and supplies) as requested. In addition, we worked with other personnel from organizations, such as the Nauticus Foundation, to ensure that the grant would run smoothly. Based on the information provided regional reports, the coordinators were satisfied with the level of support that the MATE Center provided.

Last year, several of the regional network coordinators as well as teachers (ITEST and "non-ITEST" teachers) stated that videos documenting students as they progress through engineering and construction would be extremely helpful in both selling the ROV program to administrators providing support to new teams. These ideas dovetailed nicely with what we learned regarding the type of career resources that teachers feel are needed to better interest and engage their students. See Objective 2 below for more information about these resources and the work that we have started towards creating them. Further, ROVER, with its collection of videos, photos, resources, and links to outside help, also provides this type of support.

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

Armed with input from the Curriculum and Cultural Advisory Committee, curriculum development specialist DeDee Ludwig of the Shedd Aquarium took the lead in producing a draft ROV-focused STEM curriculum that is tied to national education standards. 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 current draft of the curriculum is available by request.)

The curriculum was provided to teachers participating in the 2010 Beginner Level Summer Institute 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. These forms have and are still being collected and will be 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). Curt is also the author of two STEM project books – *Stomp Rockets, Catapults, and Kaleidoscopes: 30+ Amazing Science Projects You Can Build for LESS THAN $1* and *Kinetic Contraptions: Build a Hovercraft, Airboat, and More with a Hobby Motor*. In addition to content knowledge, Both Curt and Melody have extensive experience serving underrepresented middle school student audiences (namely students who are socioeconomically disadvantaged, ESL learners, and/or children of migrant farm workers). Their experience with these students in both classroom and afterschool settings makes their feedback particularly valuable, especially from a pedagogical standpoint. Overall, their impression of the curriculum was favorable, as evidenced by Curt's following comment:

I thought the curriculum was perfectly suited to the middle school audiences we serve. Most are at a relatively low level academically, but a few excel. The curriculum was thorough enough to reach both ends of the spectrum and to allow opportunities for each student to explore and learn in the directions of their own interest.

In addition to Curt and Melody, another significant development in Year 2 was the partnership with Immersion Presents (see www.immersionlearning.org). Immersion Presents is an arm of the SEA Research Foundation, which also includes the Mystic Aquarium, Institute for Exploration, and the JASON Project. Immersion first connected with the MATE Center in 2007 and, with support from MATE staff, began offering ROV-focused professional development workshops. Since that time, Immersion has developed ROV-related STEM curriculum resources. Partnering with Immersion on the curriculum is allowing us to gain access to their curriculum resources and content/pedagogical expertise as well as their teachers. For example, the curriculum and feedback form was disseminated to teachers participating in an Immersion workshop in April.

Feedback collected to date has been reviewed and addressed; the plan moving forward is to incorporate comments as well as photos and illustrations into draft 2 of the curriculum. From there, it will be disseminated in PDF format via regional workshops, MATE Summer Institutes, regional professional development workshops, and on ROVER. We will continue to encourage users to provide comments and suggestions for improvement so that, by the end of the grant, the curriculum is a product tried, tested, and "approved" by the target teacher/student audience.

Broader impact: To complement the curriculum, MATE is reaching out to its network of schools to gather "stories" of how students and teachers are using ROVs for projects other than the competition. For example, students in Michigan's Upper Peninsula designed and built an ROV to study zebra mussels, an invasive species in the Great Lakes. With these stories, not only do we want to capture the variety of ways that schools are implementing ROV projects (and therefore STEM learning) 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 will help other teachers to see how they can also make it "work" at their schools.

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

The first annual ITEST Summer Institute, *ROVER: ROV Education and Resources for the Classroom*, took place July 12 – 18, 2010 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 14 educators attended. Applicants were very enthusiastic in their responses to their acceptance e-mails:

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

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

OH HECK YEAH!

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 2010 application and agenda.)

In the follow-up evaluation survey, all of the 14 respondents indicated that the Summer Institute helped them understand the knowledge and skills needed for marine occupations (100%) and the current technologies used in the marine field (100%). All (100%) of the participants also 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:

It gave me a new perspective on electronics and marine science. It was relevant to my students who lived off the coast with the oil spill. It brought the real world in my classroom and opened the mind of my students to future career possibilities.

I have used the info we received at the Institute to apply for grants and am willing and able to share my knowledge with students and their parents about ROVs and where the future of jobs will be in this area.

As proposed, recruitment for the institute focused on the four regions implementing ITEST activities in Year 1. Regional coordinators notified their ITEST participants of the opportunity to attend the MATE Summer Institute during their professional development workshops. Post-workshop, regional ITEST coordinators sent a printed copy and e-mailed a two-page flyer describing the workshop, including the goals of the session. As a result of this process, eight middle school teachers from the Year 1 regional ITEST areas applied; four from the Monterey region, two from the Southern California region, one from the New England region, and one from the Pacific Northwest. Additional recruitment strategies of personal phone calls and e-mails from the Summer Institute coordinator assisted with some of these applicants. In an effort to meet our target number of 20, the institute was then opened to middle school educators from other

regionals and, later, promoted to the entire MATE network of teacher contacts. As a result, we received six additional applications.

Recruiting teachers from the ITEST regions was challenging, despite the offer of additional instruction and resources as well as funds to support travel, housing, and meals. The following are examples of the reasons provided by those who dropped or from the start were unable to attend:

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

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

Although the institute was a success, we recognized the need to start promotion and recruitment to Year 2 ITEST regions earlier in the school year (teachers informally polled said that by February many had already planned their summer activities, including family vacations and attending other professional development workshops). Organizations such as the National Middle School Association (www.nmsa.org) also provided some insights. NMSA surveys of 7,000 of its 30,000 members indicate that in most cases school principals or administrators are the decision makers for attending professional development workshops and incorporating material into the middle school classroom. Ensuring the buy-in of the principal and/or administrative staff may be the catalyst to increase the number of participants. Given this information, our Year 2 approach included more direct contact with the administrative staff of our target audience.

The second annual ITEST Summer Institute, *ROVER: ROV Education and Resources for the Classroom*, is set to take place July 6th – 12, 2011 at MPC. Taking into consideration lessons learned from Year 1, recruitment for this institute began earlier in the school year. In addition, using the insight gained from NMSA, we created a letter specifically targeted at the administration/supervisory level of potential candidates. The letter provided information as well as addressed general questions asked by administrators in Year 1, such as: How much will this cost our school? Will my teacher need leave time? What resources will we need to support the educator when he/she returns?

Another recruitment strategy created as a result of lessons learned from Year 1 was to develop a middle school program "highlights" document that could used in conjunction with the letter to administrators or could 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.

The first targeted effort occurred in September 2010 at the annual MTS/Institute for Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) Oceans Conference and Exhibition held in Seattle, WA. Educators in the PNW 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. As a result of attending this workshop, 6 PNW ITEST teachers applied to the 2011 Summer Institute.

The 2011 regional coordinators' meeting was also held in conjunction with the Oceans conference (see below for more information about this meeting). 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.

In addition to these recruitment tools, there were now a number of teacher "examples," as Year 1 Summer Institute participants returned home and could attest to the validity of the Institute. These "example teachers" combined with the regional coordinators previous rapport with the teachers from Year 1 resulted in 5 candidates applying to the 2011 Summer Institute: 1 from Florida, 2 from New England, and 1 from South Carolina.

Throughout the year, we continued to provide recruitment support to the eight Year 2 ITEST regional coordinators. Through their professional development and outreach activities, Florida, Hawaii-Oahu, and the Great Lakes – ITEST regions added in Year 2 – recruited 6 applicants.

We also provided access to example teachers and MATE staff at outreach events such as the USA Science & Engineering Festival in Washington, DC; Underwater Intervention Conference and Exhibition in New Orleans, LA; National Marine Educators Association's annual conference in Gatlinburg, TN; National Science Teachers Association's annual conference in San Francisco, CA; and MATE regional and international ROV competitions. Eight applicants came out from these activities.

All total, improved recruitment strategies resulted in 25 applications for the allotted 20 spots – a 75%+ increase in applications over last year.

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

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

Although *OceanCareers.com* (www.oceancareers.com) and the *Exploring Ocean Careers* online course have been extensively tested with college and upper level high school students, they are currently untested and unproven with middle school audiences. Much of 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 MATE's 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. The teachers express a need for career resources that are directly tied to careers and career pathways so 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.

We started interviewing and filming students as well as professionals engaged in ROV activities and are making a concerted effort to demonstrate how these activities tie directly to the workplace, just as the competition does. We will be piloting and testing a number of video strategies with students this fall.

In addition, the *Exploring Ocean Careers course* is being adapted and migrated to the ROVER web site for testing with middle school students. Our current web developer will be leaving us; we are in the process of interviewing a new company that best meets the needs for ROVER and this course transition. We plan to integrate the videos with the course content and will modify the course based on recommendations from our teacher focus groups and the advisory committee.

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

We are currently summarizing the list of 200 new elementary, middle, and high schools (including mailing addresses) that participated in its 2011 international and regional competitions. Once complete, the Marine Technology Society (MTS) will send each school one hard copy of the *Guide to Marine Science and Technology Programs in Higher Education*. Developed and produced by the MATE Center in collaboration with MTS, the guide includes detailed information about more than 1,200 programs within the U.S. The copies and associated shipping costs will be covered in-kind by MTS.

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

● Couple efforts with postsecondary academic institutions.

Each of the eight regions implementing ITEST activities in Year 2 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.

"RETURNING" ITEST REGIONS: MONTEREY, SO-CAL, PNW, and NEW ENGLAND

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 student mentors from CSUMB's Service Learning Institute, Hartnell College, and Aptos High School provided students with 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 another, local (that is also smaller and more-affordable) postsecondary school besides the University of California Santa Cruz.

In Year 1, we recognized the need for a 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 hope to make progress on that map during Year 3.

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's 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 individual hired in Year 2 to assist with ROV kit maintenance and distribution and serve as a mentor for those teachers and students who needed technical help is a recent graduate in electrical engineering. 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.

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, this year students from the UMass-Dartmouth were also mentors (thanks to the encouragement of a former BCC student who had transferred to the university). The benefits of this are the same as described above for the Southern California region. Because of UMass-Dartmouth's involvement, Meghan is also able to share information about and make the connection from BCC to bachelor's degree programs. Similar to the Pacific Northwest, the involvement of professionals from the MTS-New

England section and, specifically Lockheed Martin Sippican, provide exposure to career opportunities in ocean STEM fields.

NEW ITEST REGIONS: MID-ATLANTIC, OAHU, FLORIDA, AND GREAT LAKES

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 from the MTS-Hampton Roads section. The timing is advantageous, as the Hampton Roads section will host the 2012 MTS/IEEE OES Oceans Conference and Exhibition. In preparation for this conference, the section is looking at ways to engage and involve the local community.

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. Given the late start of activities on Oahu, the substantive connections between university programs/students and ITEST participants did not take place. However, Mark was involved with the SCOUT event and, along with Timmie and the PI, is reaching out to university engineering students and professionals as well as MTS-Hawaii members to get them involved as mentors and technical support next year. In addition, a number of the organizations that Timmie is developing partnerships with, such as Hawaii Pacific University's Ocean Institute and the Pacific Aviation Museum at Pearl Harbor, represent postsecondary educational opportunities and/or 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. Florida came on board as a Year 2 ITEST region in January; despite the late start, Erica was able to connect activities with the University of South Florida'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. In addition, RBMA (high school) 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. Like Florida, the Great Lakes came on board late in the year. However, like Erica, Sarah Waters, a sanctuary education specialist and the lead ITEST activities coordinator, made progress connecting with postsecondary institutions and technical professionals. For example, Alpena Community College assisted with recruitment of volunteers and mentors and provided access to its pool for ROV teams to practice. Exposure to instructors and students as well as visits to the campus gave ITEST students the opportunity to experience a college "environment" (people and facilities). In addition, during workshops and outreach activities Sarah 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.

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 is built on the latest generation of content management technology called Joomla (see www.joomla.org). Joomla is a popular open source content management system that allows web developers and site administrators to easily create and build web sites and web-enabled applications. Joomla offers thousands of extensions for expanding a web site's capability, while also allowing developers to build custom, special-purpose extensions. All of these features make Joomla an excellent choice for ROVER.

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 videos
- 10 images
- 9 news sources
- 28 how-to books, information, and articles
- 6 blogs
- 4 online communities
- 42 building supplies/suppliers
- 16 archived ROV competition information links
- 9 internships, scholarships, and other opportunities
- 39 general links
- 22 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.

Unfortunately, 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, during the international ROV competition. Therefore, meaningful site statistics are not available for this report.

However, there are other measures that 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: 104 followers (http://twitter.com/#!/matecenter)
- Facebook: 134 "likes" (http://www.facebook.com/pages/MATE-Center/226625134802)
    - Maximum active users in a single month: 95
- Flickr: 1,850 pictures of ROVs and participants (http://www.flickr.com/photos/matecenter)
    - Total views: 2,921

- YouTube channel: 123 videos (http://www.youtube.com/MATECenter)
    - Total upload views (since May 2007): 30,133
    - Channel views: 4,052
    - Subscribers: 54
- 2011 ROV competition registration: 2,173 registrants total (1,905 students, 259 teachers/mentors, 9 judges)
- ROV competition FAQ page: 191 posts during the 2011 competition season (26% of the posts were from student competitors; 4% were from faculty/mentors; slightly over half (52%) were from MATE staff; and 18% had an undesignated role)

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've been involved with the MATE Center, and their reason for registering with the site. Between September 2010 and June 2011, 704 users completed the survey. Seventy-four percent (74%) of those users identified themselves as students; 27% as teachers; 5% as a parent of a student interested in marine technology; 3% 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 (94%), followed by technical resources for building ROVs (32%), mentors (15%), career information (11%), 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.

ROVER hosted 100% of the participant portion of the 2011 MATE ROV competition season. This included serving as the portal for team registration. As noted above, more than 2,100 students, mentors, and judges who took part in the 2011 competitions utilized ROVER to register their involvement.

Further, ROVER provided access to the live videostream from international competition, which was held June 16-18 at the NASA Johnson Space Center's Neutral Buoyancy Lab in Houston, TX. 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. While complete statistics are not available from NASA's Robotic Alliance (the organization that hosted the actual stream), it is estimated that there were a total of 7,665 "connects" to the server from the time that the stream went live on June 16 afternoon until the time the competition events were completed on the afternoon of June 18.

In addition to ensuring that robust site statistics are being collected, plans for the upcoming year include continuing to populate ROVER with MATE and external resources. Exciting additions will be the middle school curriculum being developed under ITEST as well as the "ROV stories" gathered from teachers and students. We anticipate both of these to be very welcomed and popular resources. Also, to increase communication, we plan to "seed" more discussions by posting questions and information (and possibly hints to competition mission tasks!) more frequently.

What we hope will also be a popular (and powerful) feature of ROVER is its proposed "Mentor Hotline," a geo-referenced directory of working professionals and the "services" (design reviews, tours of facilities) that they offer. Before embarking on the development of the hotline, we have decided to do a needs' assessment in order to answer important questions, such as: What type of technical support does your team need the most? Where do you currently go to get it? Would you use this type of system to seek help? Would a collection of instructional videos focused on

specific topics meet this need? Would a forum/Q&A type set up be more useful than trying to connect with a mentor? Etc.

In addition to content and features, we plan to continue to improve the participant support and administration side of ROVER. For example, adding "competition class" to the AlumniWeb fields to make it easier to distinguish SCOUT class students when seeking ITEST evaluation data. We will also add a menu of questions that regional coordinators can select to include within their specific contest registration forms (i.e., Does your team need help finding housing? How many lunches do you need on contest day? Any special dietary needs? Etc.)

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 project strategies and related research questions 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 40% in the pre-workshop surveys (N=45) to 54% in the post- surveys (N=39). After the training, 95% 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, all of the teacher respondents (100%, 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, all of the respondents indicated that the institute helped them understand the knowledge and skills needed for marine occupations (100%, N=8 out of the 13 total attendees) and the current technologies used in the marine field (100%).

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

- **Increased Awareness of STEM Careers:** After building their ROV, 80% of the students surveyed (N=267) indicated that they knew more about careers in marine STEM.
- **Increased Interest in STEM Careers:** Roughly two-thirds of the students (64%, N=267) stated that their ROV project made them more interested in a marine career, and 65% of the teachers (N=56) observed an increase in their students' interest in pursuing a STEM career.
- **Increased Interest in STEM:** Two thirds of the students (66%) indicated that their ROV project made them want to learn more about ocean STEM. Eighty-one percent (81%) of the teachers and 91% of the parents (N=130) observed greater interest among the students in learning STEM.
- **Increased STEM Knowledge & Skills:** The majority of the teachers (91%) observed improvements in their students' STEM knowledge and skills. Parents reported that building an ROV contributed to improving their children's grades in engineering/robotics (54%), science (40%), math (32%) and computers (24%).
- **Increased SCANS Skills:** Ninety-five percent (95%) of the teachers observed increases in their students' skills in team building, problem solving, and/or critical thinking. Sixty percent (60%) of parents reported that their children were better able to work with others

due to their involvement in the ROV project; 60% 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-two percent (82%) 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, 61% of the teachers (N=56) rated the support provided by MATE as excellent, and 31% provided a rating of good, an overall positive rating of 92%.
- **Review of Curriculum Materials:** Preliminary feedback about the curriculum, provided by teachers testing the beta version, has been extremely positive, with reviewers indicating that the curriculum materials are at the appropriate level for a middle school audience.

Project Strategy 3: Modify Career Guidance Resources to Better Suit Middle and High School Students
This strategy is still in the early implementation stages so no evaluation findings are available yet.

Project Strategy 4: Build ROVER, a Cyberlearning Center
- **Increased Access to Career and Instructional Resources:** The web site is populated with an extensive and growing selection of links to internal and external resources: 701 at last count.
- **Increased Use of Web Site and Resources:** There are many indications that the web site and resources are being used, including the web site user registration survey (N=703), Twitter followers (104), Facebook "likes" (134), Flicker photos (1,850 photos with 2,921 views), YouTube videos (123 videos with 30,133 views) and ROV competition registrations (2,173).

Preliminary Findings by Gender and Ethnicity
Demographic data collected from six regions (Monterey, the Pacific Northwest, New England, Southern California, Florida, and the Great Lakes) show that half of the students were of minority background. Socioeconomic data revealed that 44% of the students came from high poverty areas.

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 underrepresented students as well as the students who traditionally participate in STEM learning opportunities. In many cases, the significant differences were in the measures of STEM knowledge, interest, and awareness *prior* to participation in the program, which is not surprising if the underrepresented students had less exposure to the subject matter before joining the program.

The complete evaluation report, including the evaluation instruments and specifics about data collection and analysis, can be found within the Addenda. The project's evaluation plan can also be found within the Addenda.

REGIONAL COORDINATORS' AND ADVISORY COMMITTEE MEETINGS

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

The 2010 MATE ROV competition regional coordinators' meeting took place on September 24th in conjunction with the annual MTS/IEEE OES Oceans conference and exhibition in Seattle, WA. The meeting was hosted by the Pacific Northwest regional ITEST coordinators and held at the UW's Ocean Sciences Building. Like last year, having the meeting in conjunction with the

Oceans conference gave participants the opportunity to attend the conference's technical sessions and visit the exhibit hall. It also allowed those who missed the 2010 meeting and had never attended the conference before to get a better sense of the breadth and depth of the ocean community and the latest developments in ocean science, engineering, technology, and government affairs. An added bonus was the tour of UW's Seaglider Fabrication Center by Fritz Stahr and Rick Rupan.

Nineteen coordinators representing 15 regional events attended. The meeting included a debrief of the 2010 competition season, lessons learned to apply to "next year," and plans for 2011. 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 several new initiatives, such as "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.

Tami Lunsford, MATE's Internship Coordinator, joined the meeting via teleconference to present lessons learned from MATE's diversity study. The study focused on barriers to participation in MATE's internship program; the lessons and resulting improvements in the internship program are applicable to ITEST recruiting efforts.

Jill Zande presented a review of the ITEST grant obligations and a summary of Year 1 accomplishments as well as lessons learned. The regionals that implemented ITEST activities in the first year told their "stories," which included their specific implementation approach, successes, and improvements planned for Year 2.

Candiya Mann, the MATE and ITEST project's evaluator, presented her findings from Year 1 as well as strategies that she developed to ease the burden of survey implementation and collection for regional coordinators. These strategies included a table summarizing the survey expectations and timelines.

Erica Moulton reviewed the lessons learned from the 2010 Summer Institute, while Deidre Sullivan queried the participants for their input on what career resources they see are needed and how to best disseminate those resources to teachers.

The 2010 meeting agenda, notes, and participant list are included within the Addenda.

Based on lessons learned from Year 1, this regional coordinators' meeting was one full day. Similarly, based on this year's lessons learned, the Year 3 meeting will be one-and-one-half days. The 2011 regional coordinators' meeting is scheduled to take place November 10-11 in Monterey, CA. MPC will host the meeting, which will help to keep costs down. By popular demand, a tour of MBARI is scheduled for the afternoon of the 11th. This tour in particular is helping coordinators of regionals outside of the U.S. to leverage their home institutions to cover travel expenses.

Advisory Committee

As reported last year, the next meeting of the project's Curriculum and Cultural Advisory Committee in Year 2 was indeed "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 from the Shedd Aquarium on the middle school curriculum. Members Kim Swan and Jenny De La Hoz from the Monterey Bay Aquarium played key roles in connecting the PI/Monterey regional coordinator with area schools and administrators (e.g., Curt Gabrielson, Coordinator of the Watsonville Environmental Science Workshop, who implemented the ROV project with students from two schools in the

Pajaro Valley and provided a substantive review of the curriculum). 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 our and their time, resources, and expertise. This includes targeting Kate Welsh from the University of Wyoming to review and critique the curriculum later this fall.

The complete list of advisory committee members, including their titles and affiliations, is included within the Addenda.

DISSEMINATION & BROADER IMPACTS

Dissemination
Between the MATE Center and its regional partners, 32 abstracts, journal papers, newspaper articles, web sites, and television and radio news stories featured ITEST grant activities. These included the following:

- http://www.heraldnews.com/d/x294377209/MOVE-OVER-ROVER-Henry-Lord-students-nab-the-top-prize-at-ROV-competition Fall River Herald News, "MOVE OVER, ROVER: Henry Lord students nab the top prize at ROV competition"
- http://www.alpenanow.com/index.php/2011/04/28/alpena-hosts-underwater-robots-competition/ True North Radio Network, "Alpena hosts underwater robots competition"
- http://www.thenewstribune.com/2011/05/11/1661243/kids-corner-middle-school-teams.html#storylink=misearch The Peninsula Gateway, Gig Harbor "Kids Corner: Middle-school teams take on underwater challenge"

Information about MATE's ITEST project was presented at 62 regional and national conferences, meetings, workshops, and/or other events, including the following examples:

- 2010 Association for Unmanned Vehicle Systems International (AUVSI) Foundations' Forum on Robotics Education
- 2010 National Council and Community Education Partnerships/GEAR UP Conference
- 2011 National Science Teachers Association (NSTA) Annual Conference
- 2011 American Society for Engineering Education Conference

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), 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, three new U.S.-based regionals joined the MATE competition network. The Pennsylvania Regional ROV Challenge (organized by robotics specialists at the School District of Philadelphia and supported and hosted by Villanova University); the Carolina Regional ROV Competition (organized by a high school instructor and supported and hosted by Coastal Carolina University); and the Wisconsin Regional ROV Contest (organized and hosted by the University of Wisconsin at Milwaukee's Great Lakes WATER Institute and School of Continuing Education and supported by Discovery World and the WIRED Regional Workforce Alliance), took place for the first time in 2010 and were held again in 2011. All three 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 MATE Center and ITEST have benefited in return via the numbers of middle school teachers and students that these regionals

have engaged. For example, the Pennsylvania regional implemented a SCOUT competition class where more than 15 elementary and middle schools participated.

Through outreach activities like the annual National Science Teachers' Association annual conference, we met individuals from other organizations who are interested in bringing the ROV competition program to their regions. For example, Allison Reilly, Curriculum Coordinator at the Jack Swigert Aerospace Academy, has invited MATE to participate in a Girls STEM Conference she is hosting at the University of Colorado-Colorado Springs (UCCS) this October. More than that, Allison is organizing a meeting between MATE and her partners at UCCS and the Air Force Academy to explore the possibility of establishing a MATE regional contest in Colorado in time for the 2012 competition "season." Liz Rayment, President & Thompson Robotics Coordinator for the non-profit educational organization Action Works, is also planning to attend. The PI connected with Liz at the Forum on Robotics Education organized by the AUVSI Foundation last August.

Foreign Regionals Leveraging ITEST

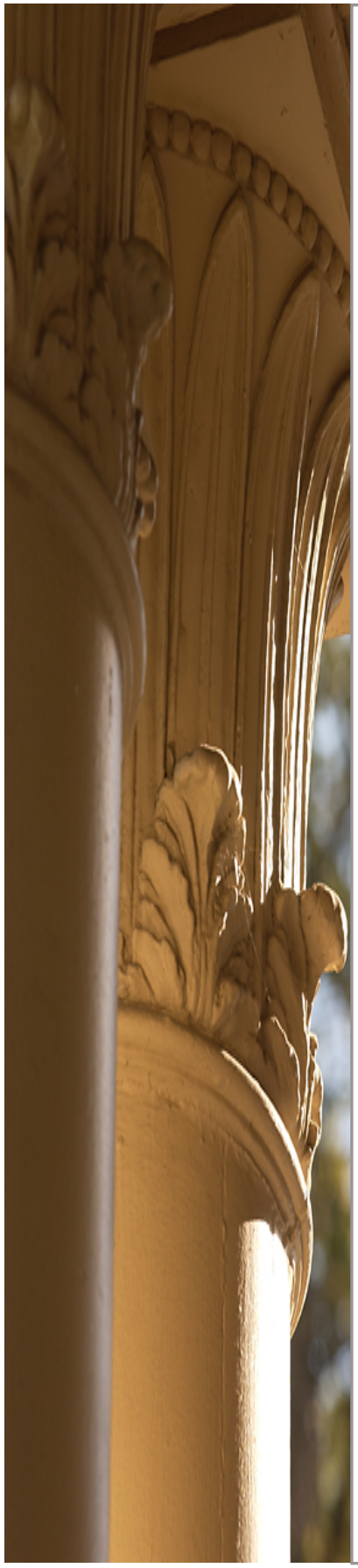
A fifth foreign regional joined the MATE ROV competition network in 2011. The Japan Regional ROV Contest was established by two teachers at the American School (high school) in Japan. These teachers are MATE Summer Institute alumni and, armed with this experience along with ITEST lessons learned and draft curriculum, convinced the school to support and host the contest. (Note: Due to the devastating earthquake and resulting tsunami, that event was understandably cancelled. It is set to regroup and take place during the 2012 competition season.)

Like Japan, the Newfoundland and Labrador (NL) regional used the ITEST grant to leverage support for its contest, supporting workshops, and outreach again this year. The Marine Institute of Memorial University of Newfoundland, the lead coordinator of the NL Regional ROV Contest, held its second SCOUT class competition on April 15-16, 2011. This year 26 schools participated, which was a significant increase from the eight schools that participated in 2010. This year's SCOUT class program was 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.

ADDENDA

_ Evaluation report and attachments
_ Letters from CSUMB Service Learning Students
_ LBCC PowerPoint Presentation to LBUSD
_ New England teacher Keith Bradley's PowerPoint Presentation describing his ROV module
_ 2010 Summer Institute application and agenda
_ 2010 regional coordinators' meeting agenda, notes, and participant list
_ Curriculum and Cultural Advisory Committee members



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

For

The Marine Advanced Technology Education (MATE) Center

August 2011

Submitted by:

SESRC

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

For

The Marine Advanced Technology Education (MATE) Center

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August 2011

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

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EXECUTIVE SUMMARY

Evaluation of Innovative Technology Experiences for 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 2011

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, 2010 and June 30th, 2011, the second year of the grant. Year-to-year comparisons 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 second 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 second year of the grant, the MATE Center continued its roll-out of targeted support for the entry-level (SCOUT) ROV competition class, from four to eight regions that cover the country from coast-to-coast: Monterey Bay, Pacific Northwest, New England, Southern California, Florida, Mid Atlantic, Oahu and the Great Lakes.

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 12th-18th, 2010.

An important component of the support for the SCOUT class was the middle school, ROV-focused STEM curriculum. In collaboration with the MATE Center, the Shedd Aquarium drafted the curriculum, which was distributed to teachers throughout the ROV competition network.

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 also beta tested the *Exploring Ocean Careers* course with high school students. This course was developed by the MATE Center with an initial focus on serving community college students. In the next year of the grant, the Center plans to complete the following tasks:

- Transition the course to the ROVER (ROV Education and Resources) website, making it publicly available,
- Link the high quality external career resources to the website, and
- Perform advance work towards the goal of creating ROV competition-focused career videos for middle school students.

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 second year of the grant, interview and survey protocols from the first year were refined and new data collection tools were developed and 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 second 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 40% in the pre-workshop surveys (N=45) to 54% in the post- surveys (N=39). After the training, 95% 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, all of the teacher respondents (100%, 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, all of the respondents indicated that the Institute helped them understand the knowledge and skills needed for marine occupations (100%, N=8 out of the 13 total attendees) and the current technologies used in the marine field (100%).

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

- **Increased Awareness of STEM Careers:** After building their ROV, 80% of the students surveyed (N=267) indicated that they knew more about careers in marine STEM.
- **Increased Interest in STEM Careers:** Roughly two-thirds of the students (64%, N=267) stated that their ROV project made them more interested in a marine career, and 65% of the teachers (N=56) observed an increase in their students' interest in pursuing a STEM career.
- **Increased Interest in STEM:** Two thirds of the students (66%, N=267) indicated that their ROV project made them want to learn more about ocean STEM. Eighty-one percent (81%, N=56) of the teachers and 91% of the parents (N=130) observed greater interest among the students in learning STEM.

- **Increased STEM Knowledge & Skills:** The majority of the teachers (91%, N=56) observed improvements in their students' STEM knowledge and skills. Parents (N=130) reported that building an ROV contributed to improving their children's grades in engineering/robotics (54%), science (40%), math (32%) and computers (24%).
- **Increased SCANS Skills:** Ninety-five percent (95%, N=56) of the teachers observed increases in their students' skills in team building, problem solving, and/or critical thinking. Sixty percent (60%, N=130) of parents reported that their children were better able to work with others; 60% 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-two percent (82%, N=130) 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, 61% of the teachers (N=56) rated the support provided by MATE as excellent, and 31% provided a rating of good, an overall positive rating of 92%.
- **Review of Curriculum Materials:** Preliminary feedback about the curriculum, provided by teachers testing the beta version, has been extremely positive, with reviewers indicating that the curriculum materials are at the appropriate level for a middle school audience.

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

This strategy is still in the early implementation stages so no evaluation findings are available yet.

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: 701 at last count.
- **Use of Website and Resources:** There are many indications that the website and resources are being used, including the website user registration survey (N=703), Twitter followers (104), Facebook "likes" (134), Flicker photos (1,850 photos with 2,921 views), YouTube videos (123 videos with 30,133 views) and ROV competition registrations (2,173).

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=267), the students were about one-third female (35%), half (50%) were of minority backgrounds, 44% came from high poverty areas, and 5% 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.

In many cases, the significant differences were in the measures of STEM knowledge, interest, and awareness *prior* to participation in the program, which is not surprising if the under-represented students had less exposure to the subject matter before joining the program.

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, 2010 and June 30th, 2011, the second 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?

Project Strategy	Research Questions
	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, 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).

Student, teacher, and parent surveys were administered at the Monterey, Florida, Great Lakes, Pacific Northwest, Southern California and New England regional events. The ITEST events at the Oahu region happened after the close date for this report so they are not included. Surveys were not administered in the Mid-Atlantic region.

[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. 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.

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.

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. Next year, there are plans to translate the survey 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.

JUDGES

In the second year of the grant, input was solicited for the first time from industry representatives serving as judges at the competitions. In order to minimize the surveying burden on the regional coordinators, this survey was only conducted at the international competition. At the next regional coordinator meeting, the coordinators will be 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, their opinions on the usefulness of the competition in preparing future employees and their demographics.

Regional Workshops

PRE AND POST TEACHER WORKSHOP SURVEYS

Pre and post paper surveys were administered to teacher workshop attendees in the Monterey, Pacific Northwest, New England and Florida 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 was 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 feedback survey had a response rate of 77% (10 out of 13), and the follow-up survey had a response rate of 62% (8 out of 13). 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.

Curriculum

TEACHER CURRICULUM FEEDBACK SURVEY

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. Responses to the feedback form were still being collected at the close of the evaluation period.

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, and document review, including the curriculum and supporting technical materials and the MATE Center's annual report.

Challenges of the Evaluation and Lessons Learned

SURVEY METHODS

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.

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.[2] [3] This survey method also reduced the data entry burden on the MATE Center's administrative

[2] This survey method was used for the entire MATE competition network, including the non-ITEST regions and the international regions. Over 1,600 student surveys and 350 teacher surveys were returned from the entire competition network in the 2011 season, far surpassing the completion numbers from prior years.

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.

The survey methods for the workshop pre and post surveys were not changed from last year, and there is room for improvement in the survey implementation. Workshop surveys were only returned from four of the eight ITEST regions. Next year, regional coordinators will again be reminded of the importance of collecting this data.

DEMOGRAPHIC DATA

Last year, 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.

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 will not be released until December 2011, thus the 2000 Census data was used for this year's analysis. Next year, the analysis will be performed with the latest poverty data.

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.

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[3] It is not clear if the surveys in the Mid-Atlantic region were not administered or were not returned to WSU-SESRC for coding and analysis.

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 original data collection plans had to be changed because they would not be possible in all regions. For instance, the evaluation plan originally called for pre-surveys of students prior to attending an introductory workshop about the program. In practice, none of the regions offered an introductory workshop for students. Thus, the student pre-survey was removed from the evaluation.

One new challenge in the second year of the grant was evaluating the ROVER website usage. This was the first year of the new website, and the webmaster did not discover until the end of the grant year that the Google Analytics software was not capturing usage statistics. As a result, the evaluation relied on peripheral website and resource usage statistics. The software is working correctly now, and better usage information will be available in the third year of the grant. Unfortunately, the lack of data for the second year means that it will not be possible to show usage trends over the course of the grant.

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 second 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.

Through the more than 200 student workshops, classroom visits, and outreach activities, over 1,900 students were involved with the program. The support for the SCOUT class included 15 regional teacher 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

The year one ITEST Summer Institute took place July 12th – 18th, 2010. 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.

The majority (60%) of Institute participants taught in middle schools or junior high schools, and most of them taught science (80%). Participants came with a wide range of teaching experience, from one year to 26 years. The participants report that they teach an unduplicated count of just over 1,000 students per year.

Figure 1: Grades/Levels Taught by Institute Participants

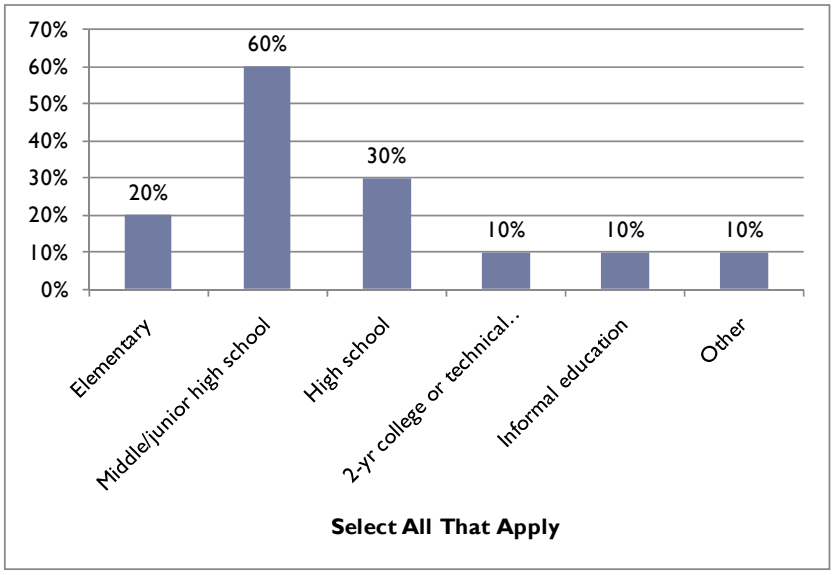
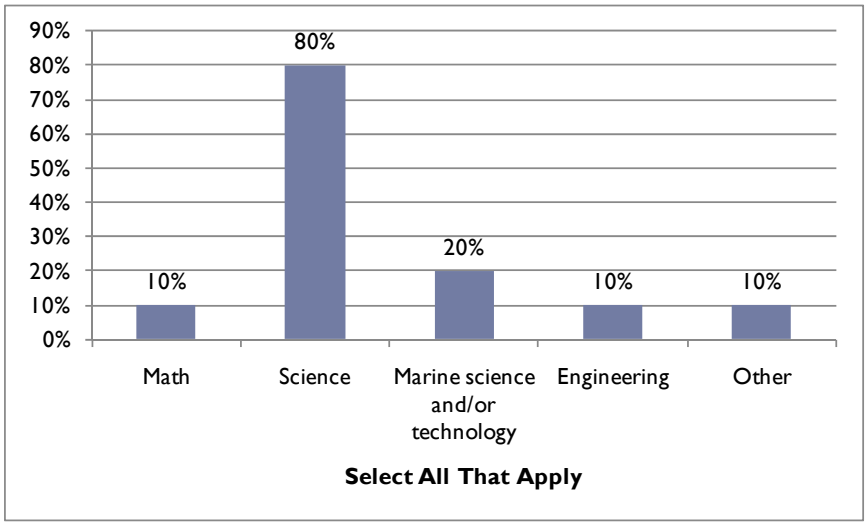


Figure 2: Subjects Taught by Institute Participants



ROVER MIDDLE SCHOOL CURRICULUM

In collaboration with the MATE Center, the Shedd Aquarium took the lead in drafting 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. Their feedback was solicited via a feedback form. In year three of the grant, the feedback will be incorporated into the curriculum, and a revised version will be released.

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 next grant year, 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 MATE Center website.

Next Steps: The MATE Center Director, Deidre Sullivan, states that through research completed over the past year, she "came to the conclusion that we could get more impact by doing something different than adjusting the course for the middle school student."

In the next year, they will link the existing, external career materials to the ROVER website, transition the *Exploring Ocean Careers* course to the ROVER website to be publicly available, and perform advance work towards the goal of creating career-focused videos that highlight the career paths possible through participating in the ROV competition. The videos that will show ROV competition students how participating in the competition could lead step-by-step to various careers. The videos will highlight present and past competitors and show how involvement in the competition impacted their lives (e.g., college admittance, employment, etc.).

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. Plans for next year include implementing the Mentor Hotline (a referral system for technical help) and seeding the discussion forums with interesting questions and comments to help encourage a vibrant online community to use the tools established in year two of the grant.

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 second year of the grant, interview and survey protocols from the first year were refined and new data collection tools were developed and administered to a variety of project stakeholders. Records review and observations of meetings and competitions also informed the evaluation. Analysis of the multiple data sources provided 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 Seattle in conjunction with the MTS/Institute for Electrical and Electronics Engineers (IEEE) Oceanic Engineering Society (OES) Oceans Conference on September 24th, 2010. This meeting allowed the regional coordinators who participated in the first year of the grant implementation to share their experiences and lessons learned. In addition, the MATE Center used this meeting to train the coordinators in how to better reach out to and support under-represented students in their competitions.

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

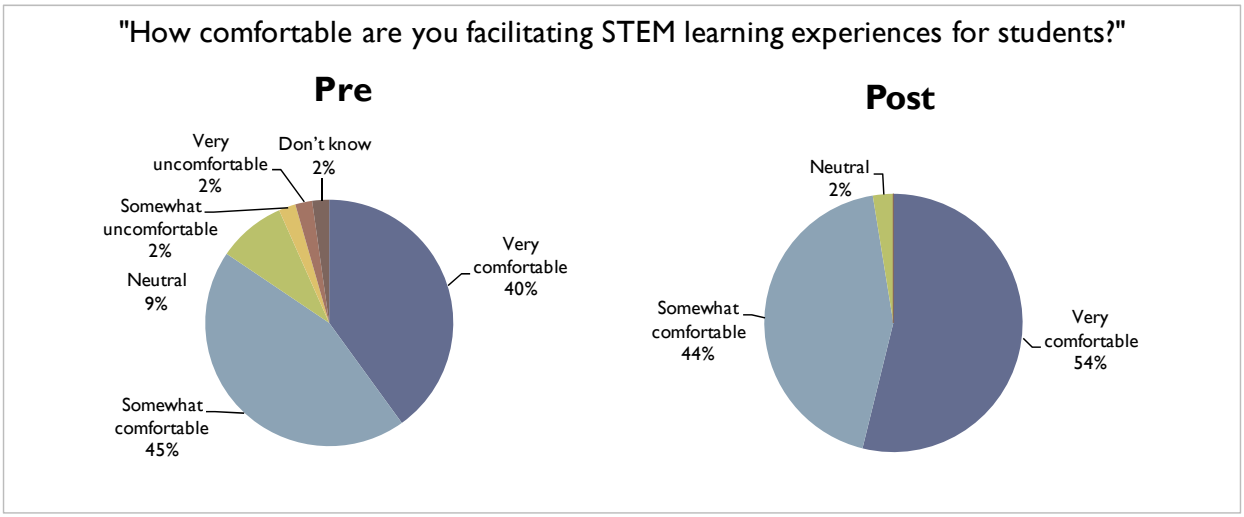
Research Question 1.1. Did the teachers gain confidence facilitating STEM learning experiences through the workshops?

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, half of the respondents (50%, N=45) stated that they had concerns about mentoring students in designing and building an ROV. Over half of the teachers (56%) 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 40% in the pre-workshop surveys to 54% (N=39) 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, 95% indicated that they felt less concerned. Overall, 87% of the respondents rated the usefulness of the training as "excellent", and 13% gave it a rating of "good".

After the competition season, teachers rated the support provided by MATE. Sixty-one percent (61%, N=56) gave a rating of excellent, and 31% rated it as good. Nine percent (9%) indicated that the support was fair, and no respondents marked that the support was poor or very poor. Open-ended comments included the following:

> *The workshops provided by MATE allowed me to overcome my lack of technical skills. I feel so much more comfortable coaching because of the support from MATE.*

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, 77% of the respondents marked that they intended to mentor a team. (The other 23% marked "maybe"). All of the respondents (100%) indicated that as a result of the training, they felt more committed to participating in the competition. One workshop participant from the New England region wrote a letter after the event describing the effect the workshop had on her:

> *Thank you so much for my training and supplies this past Saturday. I had a wonderful time, and I feel very excited about starting an after school club next fall. You are correct, more kids need to think "science" when they think about what they want to be, and a project like this can show them that they can do it and have fun, too.*

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, one participant indicated described the support provided by MATE in the following words: "The Summer Institute provided many if not all the resources I need to put a group/club together and gather the resources to move forward in training and competition."

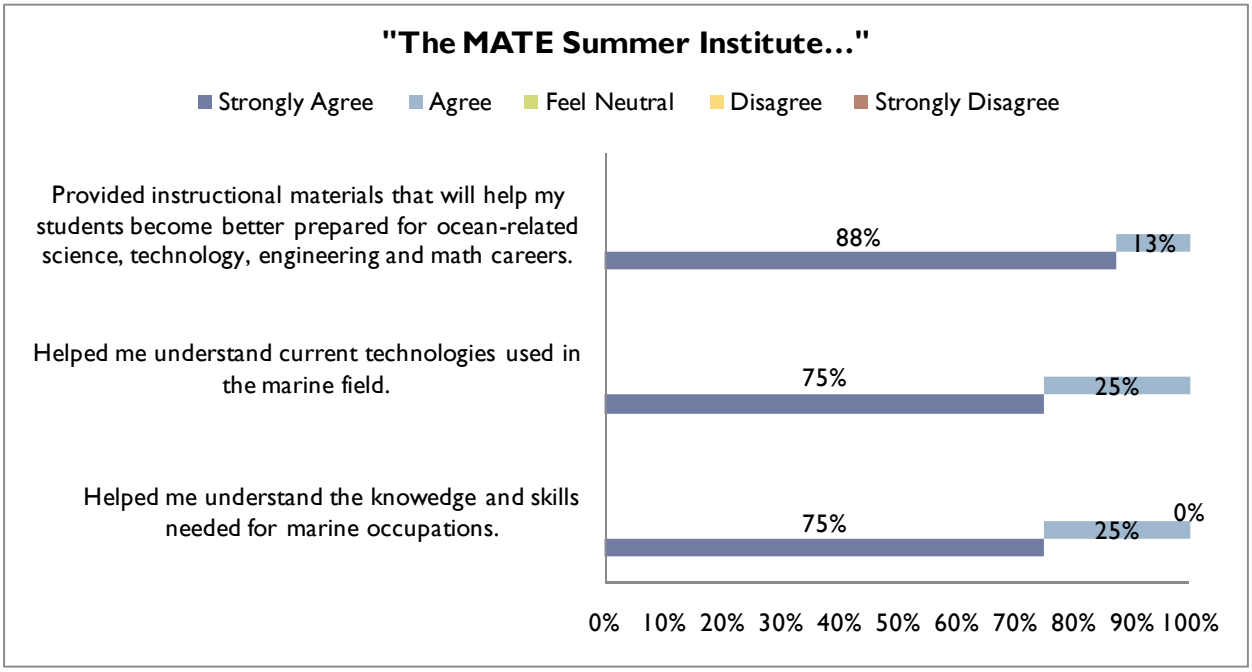
Research Question 1.3. Did attendance at the Summer Institutes lead to greater awareness/understanding of ocean STEM careers?

In the follow-up survey conducted six months after the Summer Institute, all of the respondents indicated that the Institute helped them understand the knowledge and skills needed for marine occupations (100%, N=8) and the current technologies used in the marine field (100%). All 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 (100%). Open-ended comments from the Institute participants include the following:

> *The experience opened my eyes to the Marine Biology field not only in California but in Florida as well.*
>
> *It gave me a new perspective on electronics and marine science. It was relevant to my students who lived off the coast with the oil spill. It brought the real world in my classroom and opened the mind of my students to future career possibilities.*
>
> *I have used the info we received at the Institute to apply for grants and share my knowledge with students and their parents about ROV's and where the future of jobs will be in this area.*
>
> *The collective effort of this program has embedded in me a sense that I can accomplish the goal to introduce students to this field.*

Figure 4: 2010 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, all of the respondents implemented what they learned by modifying their courses (100%) 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 85% of the respondents rating the usefulness of the Institute as good (29%) or excellent (57%) in the months following the experience. Participant comments include the following:

> *This was a fantastic experience which helped me not only become aware of careers in marine science which are applicable to students but also the physical science where I am weak in knowledge. I will be implementing a lot of this in next year's oceans unit as well as career possibilities for our students, who are surrounded by the marine industry but yet are not aware of what they need to approach those fields. Thank you for a great week!*

> *This was the best training I have ever attended - Thank you so much for taking on a newbie who was clueless when it came to circuitry - it was the best experience - thank you so much!*

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, 80% of the students (N=267)[5] indicated that they knew more about careers in marine science, technology, and engineering. Indeed, almost one-quarter (23%) marked that they knew "a lot more". Sixty-four percent (64%) stated that their ROV project made them more interested in a marine career. (Overall, 34% of the students were interested in having a career in marine science, technology, or engineering; 53% were not sure, and 13% were not interested in a career in this field.) Students mentioned wanting careers such as marine biologist, computer programmer, electrical engineer, and mechanical engineer.

Among the teachers/mentors who completed post-competition surveys (N=56), about two-thirds of the respondents (65%) indicated that they had observed that their students were more interested in

[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."
[5] All student survey results presented in this report chapter are based on a total of 267 completed surveys.

pursuing a STEM career. Eighty-eight percent (88%) agreed that the ROV program provided a valuable venue to help prepare their students for a career in marine science and technology.

Increased Interest in STEM: Two-thirds of the students (66%) 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 (54%), science (42%), math (37%), computer science (33%), and other hands-on classes or club activities like robotics, electronics and shop courses (52%). Additionally, 52% of the students wanted to learn more about deepwater oils spills, including how ROV's are used.

In the post-competition survey, 88% of the teachers/mentors indicated that their students were more interested in learning about science, technology, engineering and math. This follows patterns of prior surveys of teachers/mentors.

Parents concurred with the other sources reporting increased student interest in STEM. Ninety-one percent (91%) of the parents surveyed (N=130)[6] stated that building an ROV has made their child more interested in science, technology, engineering or math. Open-ended comments from the parents include the following:

Even more enthusiastic about marine sciences

More interest in science and physical sciences

More interested in technology

More interested in robotics

Increased STEM Knowledge and Skills: Most students entered with no knowledge about ROV's. Over half of the students (55%) did not know what an ROV was before entering this program, and for over three-quarters of the students (80%), this was their first time building an ROV. One indication of increased STEM knowledge is that before beginning their research for the

[6] All of the parent survey results are based on 130 completed surveys.

ROV Program Testimonials

Students

I loved learning about designing a system that works underwater.

I really liked it. It helped me learn how to work as a team and try something new.

It was an awesome time…having fun learning and with friends to learn with you.

It was really fun to watch the results of my hard work.

I love ROV. It has inspired me to learn.

Parents

Channeling frustration into redesign and eventual success has been a great life lesson learned through ROV!

My kids were already very strong students in all subjects, but this project really inspired them to do more. They really enjoyed all the workshops and put in lots of time on their own, even though they didn't do this with school guidance.

Faculty/Mentors

I've been so happy to see my students excited to spend more time at school.

It was remarkable…how a few 4th grade students evolved a basic idea into a fully functioning ROV with little help from me.

A great way to interest students in design, engineering, teamwork and cooperation.

competition, only 19% of the students indicated that they knew "a lot" about deepwater oil spills. After completing their research, 44% marked that they knew "a lot". Students also gained research skills as part of the competition. Forty-eight percent (48%) used the Internet to conduct research, including websites for organizations including NOAA, The New York Times, Lockheed Martin, and National Geographic. Additionally, 55% interviewed teachers or parents, and 17% used print resources, such as journals and newspapers. Twelve percent (12%) interviewed working professionals.

Among the teachers/mentors who completed post-competition surveys, 91% 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 (54%), science (40%), math (32%) and computers (24%).[7]

Increased SCANS skills: In the post-competition surveys, 95% 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:

> *Wow what amazing experience for all my students. Phenomenal benefits for them included skill building in every aspect of their education- science, engineering, interpersonal skills, meeting deadlines, cost analysis, team work, construction, electrical wiring, research, communication, presentation skills - verbal and visual, journaling, empathy, thinking about their futures and the environment… and more.*

When parents were asked what changes they have seen in their child as a result of their involvement in the ROV project, 60% reported that their children were better able to work with others; 60% 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:

> *A higher determination to expand his knowledge and see through it until completion of project*
>
> *Better at meeting deadlines*
>
> *Better leadership skills*
>
> *Taking more responsibility. Developing leadership skills*
>
> *More patience, improved problem solving skills*
>
> *Thinking more about future careers*

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

Overall Opinions of ROV Program:

Overall, parents rated their children's experience building and competing with an ROV extremely positively. Seventy-nine percent (79%) rated it as excellent, 19% gave a rating of good, and 2% marked fair. When asked how valuable the competition has been for the educational development of their child, almost two-thirds indicated that it was extremely valuable (65%), one-third stated that it was quite valuable (33%), and one respondent apiece rated it as somewhat valuable and slightly valuable. No respondents marked that it was not at all valuable.

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. As one teacher stated, "This program provides clear, exciting, and achievable goals that really engaged our team. The combination of hands on and research are great." Teachers/mentors also rated the support provided by the MATE program highly (61% excellent, 30% good, and 9% fair).

Students also rated their experiences building and competing with their ROV very positively, with close to half rating their experience as excellent (46%), and 42% providing a rating of good. Ten percent (10%) thought their experience was fair, and less than 1% gave the experience a poor or very poor rating.

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-two percent (82%) 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. Eight percent (8%) marked that the program participation did not affect how they picture their child's future, and 10% were not sure. Eighty-five percent (85%) 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. Comments from reviewers include the following:

> *I thought the curriculum was perfectly suited to the middle school audiences we serve. Most are at a relatively low level academically, but a few excel. The curriculum was thorough enough to reach both ends of the spectrum and to allow opportunities for each student to explore and learn in the directions of their own interest.*
>
> - Science Program Coordinator

Overall I really like this curriculum because it is well thought out and easy to use. I will do all of the lessons with my club. I will also adapt Biomimicry and Hydrodynamics to use with my life science classes. I hope I get to see the final copy!

- Middle School Science Teacher

Workshops: Anecdotal reports from regional coordinators, faculty, and parents indicate that the workshops targeting a broad audience (students, teachers/mentors, and parents) were at the appropriate level for the middle school audience, and that the participants were very engaged. It appears that the middle school teachers generally had minimal technical skills, and the regional coordinators struggled a bit with the teacher workshops: how to provide enough information that the teachers would have the skills to succeed without overwhelming them. The regional coordinators responded to this challenge with different approaches: most offered multiple workshops throughout the program duration. Another professional development opportunity for these teachers is the MATE Center's week-long Summer Institute.

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, all of the teachers (100%) 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 (65%), compared to those who did not attend a workshop (45%).

I am extremely impressed with MATE's support in ROV competition. I plan on expanding ROV construction into a year long after school club as well as further into maritime curriculum.

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 taken the preliminary steps by assessing and rating the available career videos. Next year, they will link these materials to the ROVER website, transition the *Exploring Ocean Careers* course to the ROVER website to be publicly available, and perform advance work towards the goal of creating career-focused videos that highlight the career paths possible through participating in the ROV competition.

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?

While the MATE Center has not yet produced new career guidance tools specifically focused on the middle school audience, career information was disseminated through the Summer Institute and presentations conducted within schools and regional workshops.

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

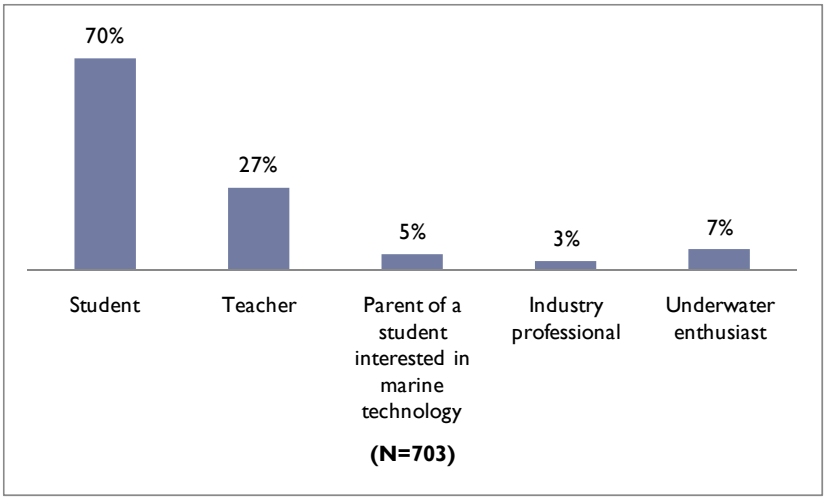
Links to External Resources

- 434 ROV Videos
- 10 ROV Images
- 9 ROV News Sources
- 28 ROV How-to Books, Information and Articles
- 6 ROV Blogs
- 4 ROV Online Communities
- 42 ROV Building Supplies/Suppliers
- 16 Archived ROV Competition Information Links
- 9 ROV Internships, Scholarships, & Opportunities
- 39 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. However, there are some other sources of data that indicate usage of the website and other MATE online resources, including the following: website user registration survey, Twitter followers, Facebook "likes", Flicker photo views, and YouTube videos.

Figure 5: ROVER Website Users, September 2010 – June 2011

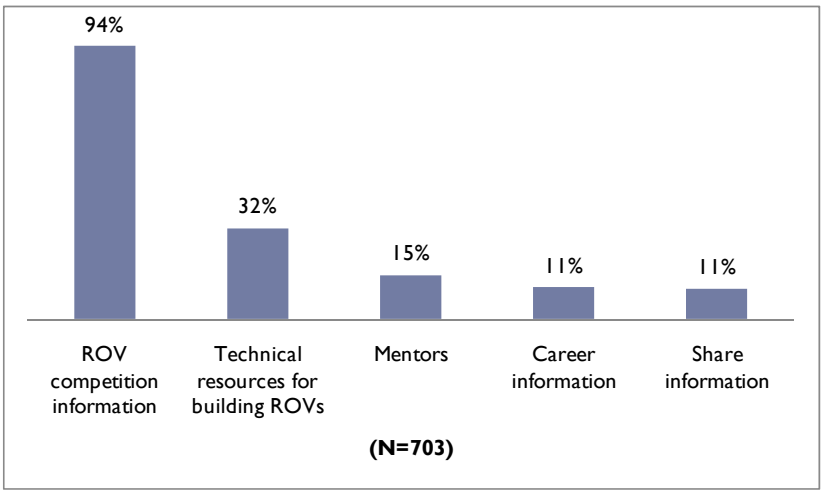


Additionally, the ROV competition registration was handled entirely through the ROVER website, which was an effective way to drive traffic to the site.

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 704 users between the website's launch in September 2010 and the international competition at the end of June 2011.

By far, the main resource that website users were seeking when they first visited the site was ROV competition information (94%), followed by technical resources for building ROVs.

Figure 6: ROVER Website, Reasons for Registering, September 2010 – June 2011



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

- Twitter: 104 followers (http://twitter.com/#!/matecenter())
- Facebook: 134 "likes" (http://www.facebook.com/pages/MATE-Center/226625134802)
    - Maximum active users in a single month: 95
- Flickr: 1,850 pictures of ROVs and participants (http://www.flickr.com/photos/matecenter)
    - Total views: 2,921
- Youtube channel: 123 videos (http://www.youtube.com/MATECenter)
    - Total upload views (since May 2007): 30,133
    - Channel views: 4,052
    - Subscribers: 54
- 2011 ROV Competition Registration: 2,173 registrants total (1,905 students; 259 teachers/mentors; 9 judges)
- 2011 International ROV Competition Live Feed: During the international competition, a live video feed was streamed on the website. The live feed was so popular that the large number of viewers crashed the server twice.

The next evaluation report, with Google Analytics capturing data throughout the year, will provide a much clearer picture of usage of the website and of the career and instructional 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?

The evaluation plan called for user satisfaction pop-up surveys to be included in the website. Since this was the first year of the new website, the web programmer was busy updating features and populating the resources so a decision was made to incorporate the registrant survey but wait on the user satisfaction survey until next year. To this point, 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 surveys will be implemented so the evaluation will have direct data to report on this evaluation question.

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 2010-2011 competition year, there were 191 posts. One quarter of the posts (26%) were from student competitors; 4% were from faculty/mentors; slightly over half (52%) were from MATE staff; and 18% had an undesignated role. 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.[8] Next year, MATE staff intend to place more effort into generating ongoing discussions in all of the discussion boards by regularly posting questions and information.

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").

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

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:

4. Leveraging ITEST activities/funding to raise additional funding by regional coordinators, teachers, schools, and student teams
5. Using ROVs and ROV-based activities outside of the competition by teachers and students
6. 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:

> *I applied for, and was awarded, a NASA Summer of Innovation grant. The amount was for $2000. The purpose is to pay for a workshop for Cub Scouts and Boy Scouts to learn about the Marine Technology Field and to design and build an ROV. We are going to have some professionals from the Marine Technology field come and talk to the boys as well as taking a field trip to Nauticus Museum. The culmination is for the boys to design, build and test 2 (possibly 3) ROV's complete with cameras.*
>
> *I received a Dean Memorial Legacy Grant from the State of California 4-H Program in the amount of $800 to be used for tools and equipment.*
>
> *I have full support of my school and its board to develop ROV programs as I wish. I even have a small budget.*

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 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 described his conversations with his team as follows:

> *I was further prepared to . . . talk to them about the importance of what they are doing and how it connects back to what they are currently learning in their classes. To my surprise, the students responded with questions about college and studying marine science. Although they did not know how to start the conversation, they were interested and wanted to know more about that application and connection of ROV building with their future.*

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 surveys (N=267), the students were about one-third female (35%), half (50%) were of minority backgrounds [9], 44% came from high poverty areas[10], and 5% reported that they had disabilities requiring accommodations. [11]

The project has made efforts to include the participation of teachers, college students, staff, and competition judges (industry professionals) of diverse backgrounds who can serve as role models for the middle school students. Half of the teachers (50%) working with ITEST teams were female, and 20% were of minority backgrounds.[12]

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[9] 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.

[10] 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; poverty data from the 2010 Decennial Census will be released in December 2011 and will be used in next year's evaluation.

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

[12] The teacher survey did not ask about disability or socioeconomic status.

This was the first year of the evaluation to incorporate a survey that collected demographic information from the industry representatives who serve as judges at the competitions. In order to minimize the surveying burden on the regional coordinators, this survey was only administered at the international competition. While SCOUT teams do not participate in the international competition, it is believed that the demographic breakdown of the judges at the SCOUT regional competitions is very similar to that of the international competition judges. Among the judges, 32% were female, 19% were of minority ethnic backgrounds, and 7% had disabilities that required accommodations.[13] Next year, demographic information will be collected on the ITEST competition judges as well.

Analysis of Student Demographics

In the last report, preliminary results presented the trends by gender and ethnicity only. This year, 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.

In many cases, the significant differences were in the measures of knowledge, interest, and awareness *prior* to participation in the program, which is not surprising if the under-represented students had less exposure to the subject matter before joining the program.

This section discusses the measures where there were statistically significant differences between the under-represented students and the other students. The analysis focuses on the following topics:

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

[13] The judges' survey did not ask about socioeconomic status.

In an interesting finding outside of these topics, students with disabilities were significantly more likely to indicate that participating in the program had opened new opportunities for them (students with disabilities: 33%; without disabilities: 13%).

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.

- **Gender:** Prior to building their ROVs, male students were more likely (11%) than the female students (4%) to know a lot about STEM careers. Both male and female students made strong gains in their career awareness, and that difference disappeared in the post-program ratings. There were no statistically significant differences in their awareness of STEM careers after the program.
- **Ethnicity:** There were no significant differences between the responses of the minority and the white students. Both groups reported increased STEM career awareness.
- **Socioeconomic status:** Students living in high poverty areas had no differences in their pre-program ratings, but they were less likely (73%) than the other students (84%) to state that their awareness of STEM careers increased after the program. Interestingly, among the students who marked that they knew more after the program, there were no significant differences between the low and high poverty students in the *amount* more that they knew.
- **Disability status:** There were no significant differences between the responses of the students with and without disabilities. Survey results showed improved career awareness in both groups.

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. 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.

Regardless of gender, ethnicity, socioeconomic status and disability status, students marked that the ROV project made them want to learn more about marine science, technology, and engineering. There

were no statistically significant differences between the under-represented students and the other students in this topic.

There were statistically significant differences in the courses that the students marked:

- **Gender:** There were no differences between the genders in their increased desire to take math, 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 computer science (male: 37%, female: 25%) or engineering (male: 67%, female: 31%).
- **Ethnicity:** There were no significant differences between the responses of the minority and the white students.
- **Socioeconomic status:** There were no significant differences between the responses of the students living in high and low poverty areas.
- **Disability status:** Students with disabilities were less likely than other students report an increased desire to take engineering courses (students with disabilities: 17%; without disabilities: 56%) or hand-on classes (students with disabilities: 25%; without disabilities: 54%). There were no differences by disability status in the students' increased desire to take math, computer science, or science.

STEM Knowledge

There were no statistically significant differences in the gains in knowledge about deepwater oil spills between the under-represented students and the other students. However, under-represented students were less likely to say that they knew what an ROV was *before* they built one, indicating a lack of exposure to the topic before joining the program:

- **Gender:** Female: 34%; male: 53%
- **Ethnicity:** Minority: 37%; white: 54%
- **Socioeconomic status:** Students in high poverty areas: 37%; low poverty areas: 51%
- **Disability status:** No statistically significant difference

CONCLUSIONS

Overall, the MATE Center successfully implemented the second year of ITEST grant activities, expanding the SCOUT class ROV competition from four to eight regions across the country. Activities supporting the entry-level ROV competition included conducting student and teacher workshops and a week-long Summer Institute, drafting a new ROV-focused STEM curriculum, assessing existing STEM career materials for middle school students, and launching the new ROV Education and Resources website.

Evaluation results continue to show strong positive outcomes for both teachers and students. For the second 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 "I think the ROV program is unique hands-on application of science/technology. Equally important is learning to work together, problem-solve, etc. This program is awesome!!!" 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.

For the first time in the 10 years of the MATE Center's ROV competition, this 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 found 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.

In the third and final year of the grant, the program will continue its roll-out to an additional four regions, bringing the total to 12. This will provide the evaluation with a larger sample size and an additional year's trend data. The final evaluation report will be summative, tracing the trends and impacts of the program across the three years of the grant and its plans for sustainability in future years.

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APPENDIX: DETAILED EVALUATION PLAN AND PROTOCOLS

The appendix includes the following items:

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

EVALUATION PLAN

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

Research Questions and Evaluation Measures

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

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

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

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

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

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

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

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

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

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

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

Table 2: Evaluation Data Sources

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

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

Evaluation Schedule

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

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

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

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

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

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

Dear Student:

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

Q14. ***Before* you began your research for this competition, how much did you know about deepwater oil spills?**

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

Q15. ***After* completing your research for this competition, how much do you know now about deepwater oil spills?**

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

Q16. Do you want to learn *more* about deepwater oil spills, including how ROVs can be used to respond to 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): _____

Q18. This year, the competition asked you to think of your team as a company. What did you think of this approach?

- ◯ Loved it
- ◯ Liked it
- ◯ Disliked it
- ◯ Hated it
- ◯ Not sure

Some questions about you:

Q19. 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)*

Q20. What competition class did you participate in?

- ◯ EXPLORER
- ◯ RANGER
- ◯ SCOUT

Regional event code:

Q21. What is your home zip code?

zip code

Q22. What is your team name? *(Please print.)*

Q23. What is your gender?

- ◯ Male
- ◯ Female

Q24. 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

Q25. Do you have any disabilities that require accommodations?

- ◯ Yes
- ◯ No

Q26. 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

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

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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 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

MATE ROV Competition -- Parent Survey

Dear Parent:

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

Thank you!

Please use a #2 pencil to answer the questions

MARKING INSTRUCTIONS

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- 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 child's experience building and competing with an ROV (underwater robot)?

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

Q2. Has building an ROV made your child more interested in science, math, technology, or engineering? Less interested? No difference?

- ○ More interested
- ○ Less interested
- ○ No difference
- ○ Not sure

Q3. How valuable would you rate this competition for the educational development of your child?

- ○ Extremely valuable
- ○ Quite valuable
- ○ Somewhat valuable
- ○ Slightly valuable
- ○ Not at valuable

Q4. Has building an ROV affected your child's grades in any of the subjects listed below?

	Grades Improved	No Difference	Grades Declined	Doesn't study that subject
Science	○	○	○	○
Math	○	○	○	○
Computers	○	○	○	○
Engineering/Robotics	○	○	○	○
Other (Please specify): _____	○	○	○	○

Regional event code:

Q5. What changes have you seen in your child as a result of their involvement in the ROV project?
(Mark ALL that apply.)

- ◯ More organized
- ◯ Better able to work with others
- ◯ Improved self confidence
- ◯ Other changes (Please describe):

Q6. Has participation in the ROV program changed how you envision your child's future? Is it easier to picture your child with a career in science, technology, engineering, or math?

- ◯ Yes
- ◯ No
- ◯ Not sure

Q7. Does your child attend...

- ◯ Elementary school
- ◯ Middle school/junior high
- ◯ High school
- ◯ College/university
- ◯ Other (Please describe):

Q8. What competition class did your child participate in?

- ◯ EXPLORER
- ◯ RANGER
- ◯ SCOUT
- ◯ Not sure

Q9. How many children do you have participating in the ROV competition today?

☐☐ # of children

Q10. As a parent, how much influence do you have on your child's choice of careers?

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

Q11. Do you have any other comments to share about your child's experience in the ROV program? If so, please write them in the box below.

THANK YOU!

Please return your completed evaluation to your child's instructor or a MATE Center representative

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 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 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 2011 international competition? *(Please mark all that apply.)*

- ○ Poolside mission judge
- ○ Engineering judge
- ○ Poster judge
- ○ Technical support
- ○ General competition support (e.g., registration desk)
- ○ 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

	EXCELLENT	GOOD	FAIR	POOR	VERY POOR	DON'T KNOW
Q03. Overall, how would you rate your experience volunteering with the MATE ROV program?	○	○	○	○	○	○
Q04. How would you rate the 2011 ROV competition logistics?	○	○	○	○	○	○
Q05. How would you rate the 2011 ROV competition support provided to the judges and volunteers (information, guidance, etc.)?	○	○	○	○	○	○

Q06. 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..**	○	○	○	○	○	○

Q07. Please mark the extent to which you agree or disagree with the following statements about the ROV program:

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

Q08. 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	○	○	○	○	○	○

Q09. Do you currently work in a technology related field?

- ○ Yes
- ○ No **-- Skip to Q12**

Q10. If an entry-level job or internship were available at your organization, would you consider the college students at the competition to be strong candidates?

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

Q11. Has your organization hired any students who participated in the MATE ROV program?

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

Q12. How many years have you volunteered with the MATE ROV program?

_____ years

Q13. Have you ever competed in a MATE ROV competition? *(Mark all that apply.)*

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

Q14. What is your gender?

- ○ Male
- ○ Female

Q15. 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:

Q16. Do you have any disabilities?

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

Q17. 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, November 14, 2009

Monterey Peninsula College

Using Underwater Robots to Teach Technical & Teamwork Skills

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

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

2. Do you have any concerns about mentoring students 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, November 14, 2009

Monterey Peninsula College

Using Underwater Robots to Teach Technical & Teamwork Skills

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

1. How would you rate the usefulness of this training?
   - ☐ 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 2010

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 MATE Summer 2010 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 2010 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- Bill Kirkwood, MBARI	◯	◯	◯	◯	◯
Guest speaker- Joe Slovacek	◯	◯	◯	◯	◯
Guest speaker - Jeremy Hertzberg, MPC	◯	◯	◯	◯	◯
ROV in a Bag exercise	◯	◯	◯	◯	◯
Lessons on frame building and design	◯	◯	◯	◯	◯
Lessons on electricity	◯	◯	◯	◯	◯
Building the ROV	◯	◯	◯	◯	◯
MBARI & Vessel Tour	◯	◯	◯	◯	◯
ROV competition	◯	◯	◯	◯	◯

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)

ROVER Curriculum
Faculty Assessment
Rev. 4/21/11

Thank you for providing feedback on the ROVER Curriculum! You are working with the beta version of the curriculum. As such, your opinions, insights and suggestions are crucial. We want to hear it all – the good, bad, and ugly. Please be as ***specific and detailed*** as possible in your comments. This will help us improve the curriculum so that the next edition is more useful for you.

Please tell us how you used the curriculum.

1. Did you use the curriculum as part of an in-school course or an after-school program/club? (Mark all that apply)
   - ☐ In-school course
   - ☐ After-school program/club
   - ☐ Other: Please explain: _____

2. How did you incorporate the curriculum into your class or program? (Mark all that apply)
   - ☐ Used the chapters as complete, stand-alone modules
   - ☐ Integrated portions of a chapter or activity into other lesson plans
   - ☐ Other: Please explain: _____

Please tell us a little about yourself.

3. We would like to hear how the curriculum works for teachers with different backgrounds in science and technology. How comfortable are you with the science and technology concepts in the curriculum?
   - ☐ Very comfortable
   - ☐ Somewhat comfortable
   - ☐ Somewhat uncomfortable
   - ☐ Very uncomfortable
   - ☐ Not sure

4. How many years experience do you have teaching science/ technology or leading activities on these topics?
   - ☐ No experience
   - ☐ Less than 1 year
   - ☐ 1-3 years
   - ☐ 4-6 years
   - ☐ More than 6 years
   - ☐ Not applicable. Please explain: _____

5. Before using this curriculum, had you built an ROV before?
   - ☐ Yes
   - ☐ No
   - ☐ Not sure

Please tell us about the students you taught with the curriculum.

6. When you used the curriculum, approximately how many students were you teaching? _____

7. What are the grade levels of the students you taught with the curriculum? (Mark all that apply)

☐ 1st	☐ 5th	☐ 9th
☐ 2nd	☐ 6th	☐ 10th
☐ 3rd	☐ 7th	☐ 11th
☐ 4th	☐ 8th	☐ 12th

8. Among the students you taught with the curriculum, please estimate the percentage in each demographic category:
   - _____ % Female
   - _____ % Low income
   - _____ % English as a Second Language (ESL)

9. Please estimate the ethnic breakdown of your students.
   - _____ % African American/Black
   - _____ % Hispanic/Latino/a
   - _____ % Asian
   - _____ % White
   - _____ % Other: _____

10. Is there anything else we should know about your students?

The next set of questions asks for your overall impressions of the curriculum.

11. Overall, how would you rate the curriculum?
    - ☐ Excellent
    - ☐ Good
    - ☐ Fair
    - ☐ Poor
    - ☐ Very poor
    - ☐ Don't know

12. What are the most successful aspects of the curriculum?

13. What are the biggest deficiencies of the curriculum?

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

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not sure
14. The content is appropriate for the middle school/junior high age audience.						
15. The materials actively engage the students to promote content learning.						
16. There are clear guidelines and background materials to support teaching the content.						
17. The curriculum uses appropriate strategies to meet the needs of special/diverse audiences.						
18. The materials are free of bias (racial, ethnic, gender, etc.).						

19. For each of the statements above with a response other than “strongly agree”, please provide additional detail.

The next set of questions asks for your feedback on the curriculum chapters you used. Please be as *specific and detailed* as possible! Provide examples! Give us every opportunity to understand the deficiencies you find in the curriculum so that we can correct them.

20. Which curriculum chapters did you use? (Please mark all that apply)

- ☐ Introduction to ROVs
- ☐ Scientific Career Connections
- ☐ Safety First
- ☐ Time and Resource Management
- ☐ Biomimicry
- ☐ Hydrodynamics
- ☐ ROV Design
- ☐ Underwater Force
- ☐ ROV Motors
- ☐ Electricity in a Bag
- ☐ Electrical Assembly
- ☐ ROV Frame Construction
- ☐ Motor and Camera Mounting
- ☐ Understanding Buoyancy
- ☐ Understanding Balance
- ☐ ROV, Buoyancy and Balance
- ☐ Final Touches
- ☐ Using the Robot
- ☐ MATE Competition
- ☐ Website Resources
- ☐ Literature Resource

Please complete one block of questions below for each chapter that you used.

For additional space, please use the back of the paper, or if you're completing this electronically, feel free to copy and paste additional blocks of questions.

21a. **Chapter name:** _____

	Excellent	Good	Fair	Poor	Very Poor	Not sure
Completeness *(No additional details needed)*						
Accuracy *(Factually accurate)*						
Clarity *(Info is clear & unambiguous)*						
Accessibility *(Understandable by a wide range of students)*						
Effectiveness *(Advances student learning)*						

21b. For each item not rated as "excellent", how could it be improved?

21c. Is there anything that you particularly liked about this chapter?

22a. **Chapter name:** _____

	Excellent	Good	Fair	Poor	Very Poor	Not sure
Completeness *(No additional details needed)*						
Accuracy *(Factually accurate)*						
Clarity *(Info is clear & unambiguous)*						
Accessibility *(Understandable by a wide range of students)*						
Effectiveness *(Advances student learning)*						

22b. For each item not rated as "excellent", how could it be improved?

22c. Is there anything that you particularly liked about this chapter?

23a. **Chapter name:** _____

	Excellent	Good	Fair	Poor	Very Poor	Not sure
Completeness *(No additional details needed)*						
Accuracy *(Factually accurate)*						
Clarity *(Info is clear & unambiguous)*						
Accessibility *(Understandable by a wide range of students)*						
Effectiveness *(Advances student learning)*						

23b. For each item not rated as "excellent", how could it be improved?

23c. Is there anything that you particularly liked about this chapter?

24a. **Chapter name:** _____

	Excellent	Good	Fair	Poor	Very Poor	Not sure
Completeness *(No additional details needed)*						
Accuracy *(Factually accurate)*						
Clarity *(Info is clear & unambiguous)*						
Accessibility *(Understandable by a wide range of students)*						
Effectiveness *(Advances student learning)*						

24b. For each item not rated as "excellent", how could it be improved?

24c. Is there anything that you particularly liked about this chapter?

25a. **Chapter name:** _____

	Excellent	Good	Fair	Poor	Very Poor	Not sure
Completeness *(No additional details needed)*						
Accuracy *(Factually accurate)*						
Clarity *(Info is clear & unambiguous)*						
Accessibility *(Understandable by a wide range of students)*						
Effectiveness *(Advances student learning)*						

25b. For each item not rated as "excellent", how could it be improved?

25c. Is there anything that you particularly liked about this chapter?

Thank you for your feedback!! Please return this form to your regional coordinator or the MATE Center Independent Evaluator, Candiya Mann (candiya@wsu.edu or fax: 360-586-2279)

Dear Jill,

As a final assignment for my Spring 2011 CSUMB service-learning course, ENVS 384S - Social and Ecological Justice, each of my students wrote a letter to their service-learning site supervisor, which I have included below.

Thank you for the time and effort you put into creating such a rewarding service-learning experience for Cortland.

With great appreciation,

Dan Shapiro

Instructor, ENVS 384S - Social and Ecological Justice

Jill Zande, Associate Director for MATE Center

Dear Jill Zande,

I would like to thank you for the opportunity to mentor a wonderful set of students from H.A. Hyde Elementary School in Watsonville, as they participated in this year's ROVER project. The hands-on approach to this project helped spark an interest of marine science and applied technology to the young students who otherwise had no desires for such fields and applications. The experiences I have gained will truly be memorable and I only wish the best for any continued robotic activities in the near future.

Through the weeks of volunteering with the ROVER project I have gained a stronger understanding of some of the educational gaps, such as science communication, that occur due to the lack of educational experiences and opportunities in varying communities. In particular, the students at H.A. Hyde Elementary School had never experienced an educational opportunity like the ROVER project before. Mentoring these students on building their very own ROV was a great way to introduce them to something new and exciting. In addition this project helped the students develop technical skills as well as skills to work as a team. I personally feel that providing this opportunity to these students opened up a channel for science communication and in a way helped close a part of the educational gap.

It was great to learn that an objective for the MATE Center was to provide each class, or participating group the same and reasonably equal opportunity to learn about ROV's, their applications for science, and even build one. In this sense, I consider this a rare and unique opportunity for students to get involved with something new and hands-on. With my presence and involvement with the MATE Center, I only hope to enhance this unique opportunity, especially with students who do not really have easy access to do these sort of projects on their own. In addition, I hope that my help has become part of a wonderful memory for the students involved this year, and that this memory will stay with them as they decide which field of interest they wish to pursue in education in their later lives.

When I began working with Ms. Denise's students at H.A. Hyde Elementary School, I was surprised to hear of the individual students lack of experience of just visiting the ocean, even though they were not very far away from it. In a sense, this project helped spark a little more interest in their lives to get out there and learn more about the ocean, Monterey Bay, and all its wonderful inhabitants and ecosystem services. From the beginning the students grabbed hold of the concept of building their very own ROV and from there took off on their own innovative ideas even though none of them had any prior experience in doing this. My job as the mentor was great in that I watched them put things together, realize it did not work, try something new, and if that did not work then they came to me. I encouraged them to work as a team and ask each other questions over their designs before coming to me, which was a great approach because they developed amazing critical thinking skills that I am sometimes still surprised about. I was always there to provide my best knowledge towards making their creation more efficient and effective, but in the end, the design and most of the build was completely done by those students. They were proud of it, and I was proud of them.

The paramount event for this project was competition day at Monterey Peninsula College. My class worked hard for several months to get here, and they made it. Even though we did not rise to the top as champions, we made great progress throughout the year to bring the students and their creations to compete against others. Most importantly, the students had fun just to be there and try out their ROV. I was ecstatic to hear the students plan for the next year in making improvements in their designs and expectations, which I believe was the main take away from this entire experience. Even when the students managed to get their ROV stuck on the oilrig structure in the first event (which I think we were the only ones who were able to skillfully do so), I observed the working minds of young scientists as I overheard them saying they needed to correct the buoyancy for the next event because the robot was a little too heavy. They even discussed how for next year's competition, if the events were the same, they would include some sort of flat ramming device to easily push the oilrig's turning valve. Coming from a few fifth graders I was amazed at how their minds worked. As a student myself with a high interest in marine science, I hope one day to hear that this experience has opened doors for other potential science interests or career paths for those students.

This was my first experience as a mentor for this program, as well as just being a part of something in Watsonville. I have learned a lot from working with your program as well as the students who got involved. I have even learned how to more successfully communicate with students about science and applied technology. Science communication in general is a struggle that persists throughout our communities due to its tricky subjects and understandings. I feel that the ROVER project helped bring some context to the students that allowed for easier understandings of the importance of science and the purpose of using technology, such as the ROVs, to expand and explore further depths of science.

Sincerely,

Cortland Jordan

Dear Jill,

As a final assignment for my Spring 2011 CSUMB service-learning course, ENVS 384S - Social and Ecological Justice, each of my students wrote a letter to their service-learning site supervisor, which I have included below.

Thank you for the time and effort you put into creating such a rewarding service-learning experience for Maren.

With great appreciation,

Dan Shapiro

Instructor, ENVS 384S - Social and Ecological Justice

Dear Jill Zande,

When I first heard about MATE's ROVER project, I thought that it was an interesting hands-on approach to building students' interest in not only marine science but also the use of technology to promote marine science. I originally viewed this project as an extension of the classroom. I thought it would provide an alternate view of science for the students participating who did not have an understanding of marine science or technology. Since neither of these subjects are taught at the middle school or high school level, I considered the ROVER project to be an expansion of the students' learning. By promoting this project in schools across Monterey County, it provided a more equal distribution of resources and information to students with varying accessibility to marine environments. I expected students to connect with the ROVs function in terms of the ROV competition theme of capping an oil rig. The ROVER project has an end goal of building an ROV that works, so I assumed that was the main focus for the students.

When I was started working with the middle school students in the classroom, I was pleasantly surprised by how the process clicked with the students and how eager they were to work on their ROV. Many students had their heads down in a type of trance with their control boxes in which they were stripping wires, crimping exposed ends, crossing wires, and screwing them into place. I was particularly shocked at how adept the students were with the tools, especially tools that they had never seen before. Some girls were stripping and crimping wires with all of their might because they barely had the strength to use the larger tools. (When they brought the wires to me to check, I always made sure to tell them that they were very strong even though I gave the crimpers a tighter squeeze.) None of the students were bothered by these minor hiccups. They all dedicated themselves entirely to their work and rarely looked up. There were times in which the room was silent because everyone was concentrating. It almost made me laugh out loud because the students were taking their ROV construction so seriously. With the dedication and excitement shared by the students, I was further prepared to not only help the students with the ROV building process but to talk to them about the importance of what they are doing and how it connects back to what they are currently learning in their

classes. To my surprise, the students responded with questions about college and studying marine science. Although they did not know how to start the conversation, they were interested and wanted to know more about that application and connection of ROV building with their future.

Building ROVs is a new experience for me, so my awareness regarding how the students would view my participation was rooted in lack of self-assurance about the task. However after working with the middle school students, I began to understand that most of them felt the same way. This was a new experience for them, and they did not really know what they were doing. They made me feel more comfortable because building the ROVs became a team effort in which we were all working through it together. My initial impression was that most of the students would be hesitant about constructing an ROV and that they would need a lot of supervision. However at the middle school level, all of the students that I worked with jumped right into the construction process with little hesitation and were very adept in their abilities. The boys seem to mostly know what they are doing. However after a quick explanation, the girls jump right along with the boys and start working with tools that they have never seen before. It was a surprising reaction to see that they had little hesitation but that means that they have the confidence to continue despite a few mistakes and setbacks. I commend the openness from the students to engage in new activities with such vigor. This aspect of disregard regarding the minor bumps in a project is something that I have learned from the students. Overall, we all learned about the mechanics of ROVs and how to build a functional ROV. Having this technical and engineering experience will provide the students with a great background for future work in science and hopefully open them up the possibility of new opportunities that they had not previously imagined.

The culminating (and probably most exciting) event of this project was the regional competition day at Monterey Peninsula College. Having worked closely with one school, it was amazing to see so many students participating from a variety of schools. This was a big event and everyone (including the parents, “coaches,” and students) treated it that way. Even with all of the excitement of competition day, I think that this was the moment where students saw the larger implications of their work. They we prepared to cap an oil rig and pick up benthic organisms for the competition, but I think seeing everything set up and going through the tasks broadened their understanding for the importance of their work. Building the ROVs was a great experience for the students to learn new skills while making something fun in after school programs, however competing the marine related tasks showed the students why they built the ROVs. There was a moment during the competition where I stood at the edge of the pool and watched groups of students at all eight stations completely focused on their tasks. Granted most of them were focused on completing the task to win, but that involved successfully achieving the marine related tasks. They were worried about real problems that oceanographers face, such as the tether getting stuck or impaired visibility. At that moment, I saw the students at mini-scientists who were making progress to test how to more efficiently cap an oil rig and pick up benthic organisms. This “game” has very real application that I think most of the students grasped during the competition.

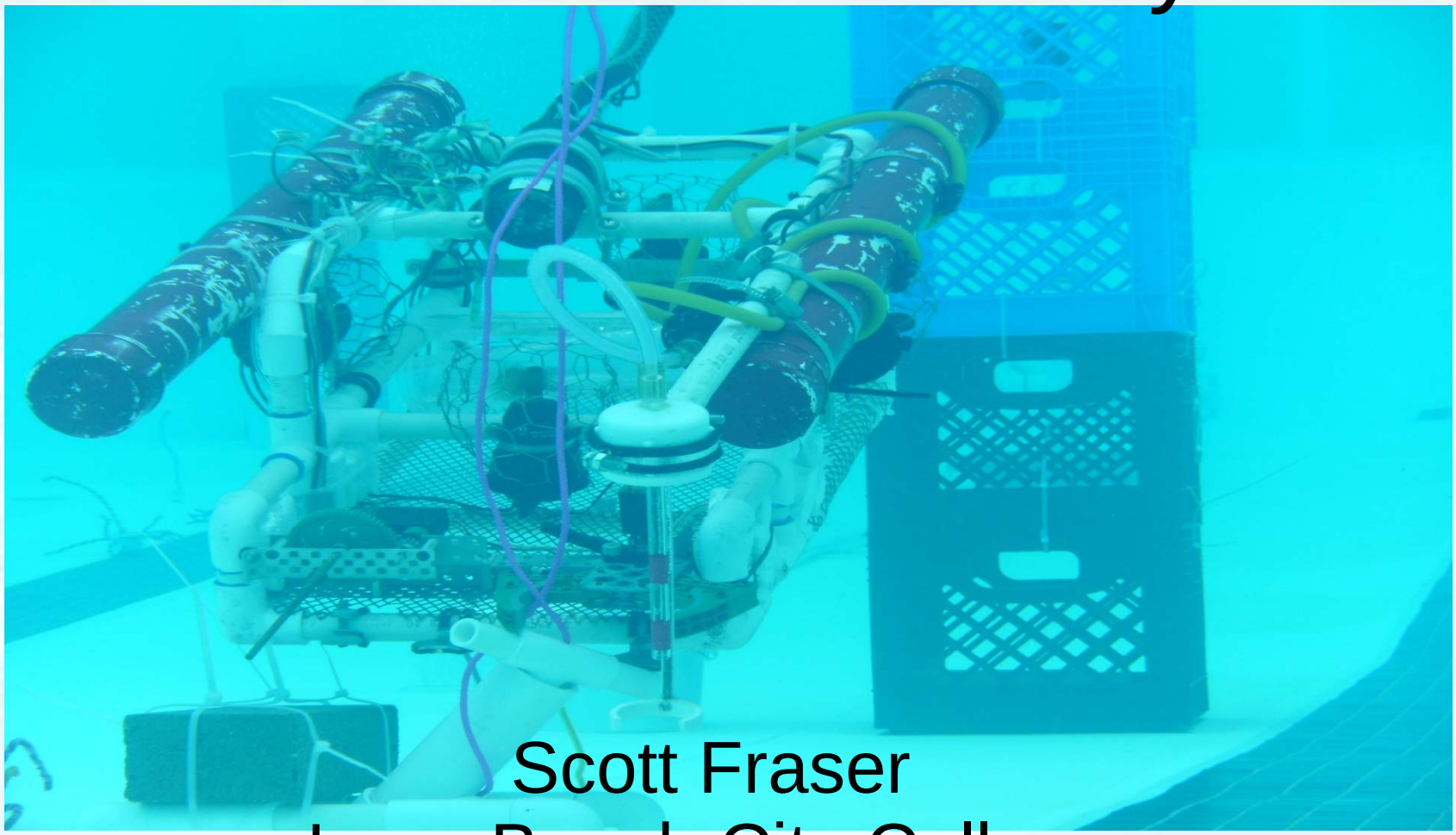
Participating in the ROVER project was more than an introduction to marine science and technology for the students. For many of the students, it was a starting point of interest that jump-started a possible career in (or at least connection to) marine science and uses of technology. I no longer

view this project as an extension of the classroom but as its own entity that has connected with students at a deeper level because they were directly involved in the entire process – from what an ROV does to completing the missions on competition day. Thanks to my participation in the ROVER project, I have learned how to more successfully communicate with younger students about science. It can be a tricky subject to share and explain at a level they understand but providing context and a possible application helped them understand the importance and purpose of science. In connecting with other adult community members that have a higher education or more life experiences, I believe that similar ideas can be applied in helping them understand scientific principles and applications. Science communication is a complicated endeavor due to the variability of target audiences, but through science education, such as the ROVER project, there is a higher possibility of successful communication and understanding.

Best Wishes,

Maren Mitch

"Underwater Robotics Pathway: LBUSD to LBCC and Beyond



Scott Fraser
Long Beach City College
Electrical Technology Department

Robotics at LBCC History

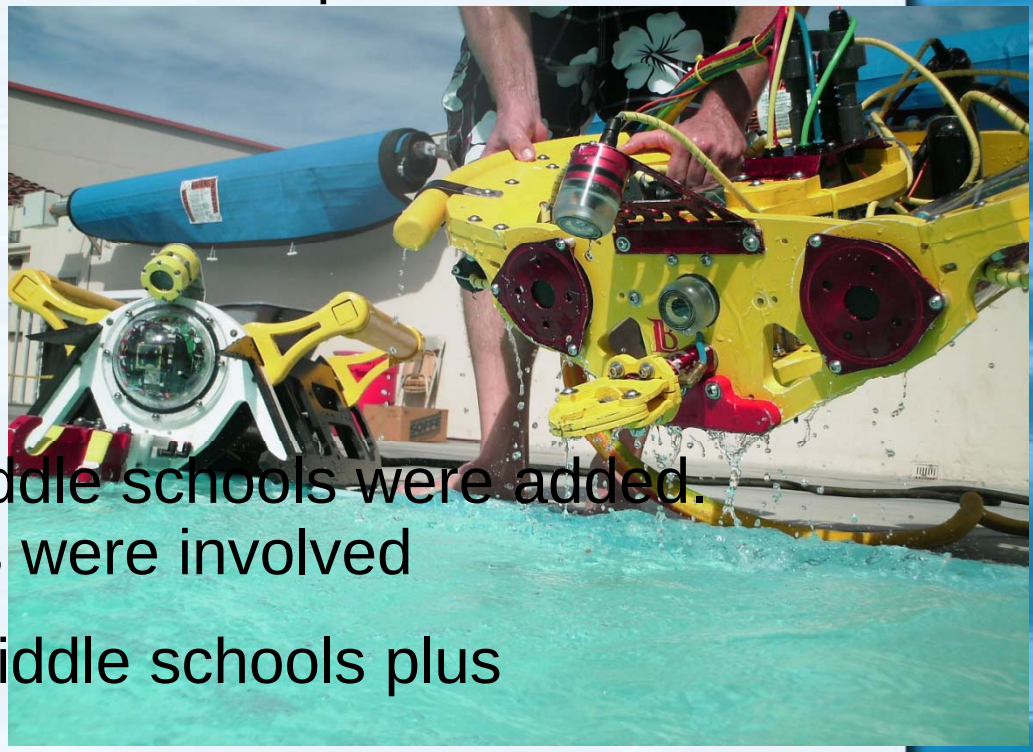
- Donation of industrial robots from IBM in 1999
- Immediately incorporated into the electrical program, updating and existing robotics class that used “robotic trainers”
- Students enjoyed the class, but there were no direct pathways to JOBS.

LBCC & MATE

- Marine Advanced Technical Education Center
  - National Science Foundation Funded
  - Monterey, CA
- Summer institute 2003
- Lessons learned were immediately incorporated into robotics classes starting Fall 2003.
- Participated in 2004 MATE ROV Competition in Santa Barbara.
- We will never be the same.....

LBUSD Involvement

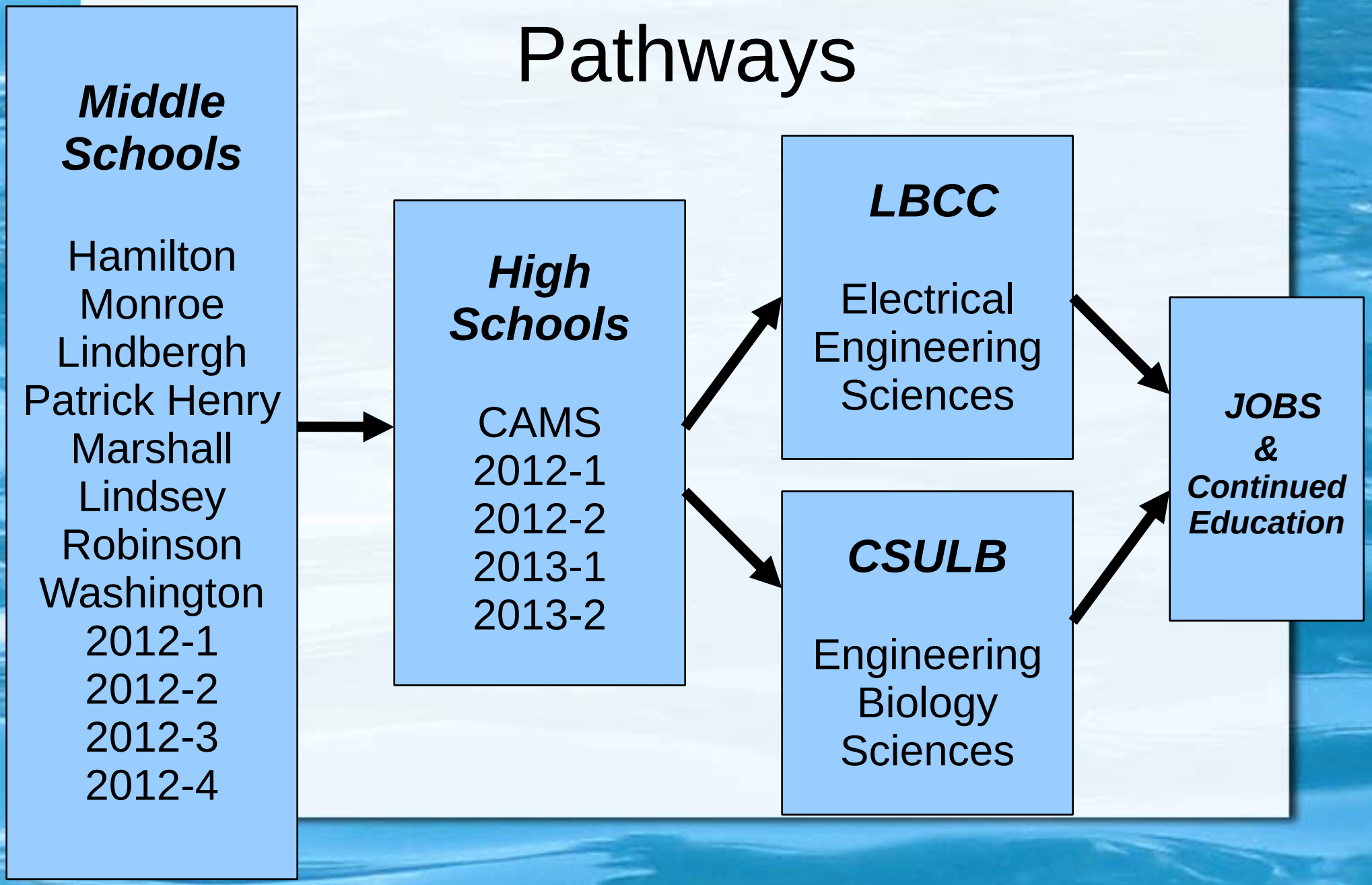
- 2010 – Four LBUSD middle schools took place in the NSF ITEST Grant. The grant paid for materials, tools & training, LBCC TechPrep covered the teacher stipends
  - Teacher Training
  - Materials
  - Tools
  - Competition
- 2011 – Four new LBUSD middle schools were added. Approx 150 LBUSD students were involved
- 2012 – Four more LBUSD middle schools plus two High Schools?



LBUSD Middle School

- Teachers were involved in two day long training sessions at LBCC Electrical Department.
- LBCC Electrical students were assigned to the new schools to assist the teachers in the classroom.
- LBCC provided each teacher with a package of parts and tools. The parts are largely PVC plumbing parts and are reusable
- Teachers and students participated in a day long practice session at the LBCC pool.
- Students competed in the SoCal ROV Flyoff Regional competition at the LBCC pool.
- Approx. 150 LBUSD students were involved.

Pathways


Middle Schools
Hamilton
Monroe
Lindbergh
Patrick Henry
Marshall
Lindsey
Robinson
Washington
2012-1
2012-2
2012-3
2012-4
High Schools
CAMS
2012-1
2012-2
2013-1
2013-2
LBCC
Electrical Engineering Sciences
CSULB
Engineering Biology Sciences
JOBS & Continued Education

The Results

Jon Chavez	CSULB - Engineering
Matt Romesburg	CSULB - Engineering
Nathan Grefe	CSULB - Engineering
Emily Morrow	CSU San Bernardino - Anthropology
Jesus Zavala	Electrician
Jan Reside	CSULB - Engineering
Ferruh Unlu	LBCC - Computer Science
Baxter Hutchinson	Woods Hole Oceanographic Institute – ROV Tech
Stuart Cook	LSU – Research Assistant
William Hillhouse	CSULB - Engineering
Yasin Khalil	LBCC - Engineering
Ricardo Casaine	Merchant Marines
Bryan Bischoff	MGM Transformers – Electrical Engineer
Ian Jasper	Millenworks - Weaponized Robotics Engineer
Adam Ramsey	Oceaneering – ROV Tech
Andy Walsh	Oceaneering – ROV Tech
Josh Ford	Oceaneering – ROV Tech
Terry Allen	Oceaneering – ROV Tech
Francisco Canul	Port of Long Beach - Crane Mechanic
Maria Borja	UC San Diego - Engineering
Harleigh Williams	Underwater Systems Inc Project Manager / Electrical Engineer
Cliff Colella	US Navy, Nuclear Engineering
Amy Whittaker	CSULB – Engineering
Ben Erwin	Dr. Robert Ballard's R/V Nautilus ROV Tech

I

LBUSD Future Work

- Increase the number of high schools involved up to five.
- Integrate the STEM Project Based Learning into the classroom.
- Develop a funding source for materials and future training.

LINKS

Marine Advanced Technical Education Center http://www.materover.org

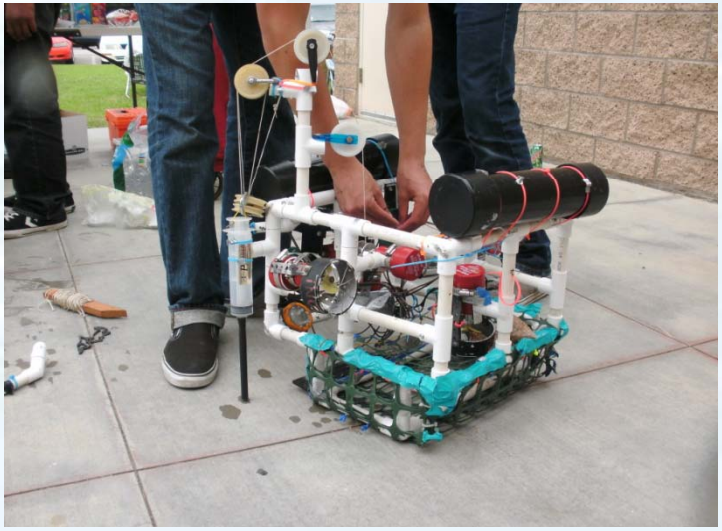
Photo gallery from past competitions http://www.vikingexplorer.org/gallery

Video on BP oil spill with LBCC student at ROV controls
http://bp.concerts.com/gom/chokeandkill_rovs_072010.htm

R/V Nautilus http://www.nautiluslive.org

ROV Jason http://www.whoi.edu/page.do?pid=10755

ITEST Resources http://www.vikingexplorer.org/MATEROV/ITEST_Workshop_Resources.pdf



LBCC Electrical Program

- 45 Unit Associate Degree Program
- Core Classes of Electrical Theory, Math, National Electrical Code & OSHA Safety
- Elective Credits can be taken from a wide range of areas
- Hands on program with industry driven emphasis on industrial electrical
- Approx 700 students per semester
- Http://elect.lbcc.edu

Elective Pathways

- Automation Technician
- Cisco Networking and Low Voltage Wiring
- Contracting & Estimating
- Solar & Renewable Energy
- Traffic Signal Technician
- Underwater Robotics

ROV Unit

By Keith Bradley
Henry Lord Middle School
8th Grade Marine Science

ROV Unit

ROV UNIT Pacing Chart

- Day 1- Introduce ROVs
  - *Power Point Slideshow defines ROV, identifies some ROV tasks, videos to see ROVs in action*
- Day 2- Hydrodynamics Lab
  - *Define Hydrodynamics and drag*
  - *Experiment on various shapes to determine which shapes produce the most and least drag*
- Day 3- Buoyant Force Lab
  - Measure gravitational force on an object in air then place object in water to introduce and define buoyancy
- Day 4- Isometric and Orthographic Drawings
  - Students design an orthographic drawing of ROV
- Days 5 thru 9- Build ROVs
- Days 10 thru 11- Test ROV Maneuverability

Massachusetts Science and Technology/Engineering Curriculum Framework

- Physical Sciences (Chemistry and Physics), Grades 6–8
  - **Differentiate between weight and mass, recognizing that weight is the amount of gravitational pull on an object.**
    - *Compare ROV weight in and out of water.*
    - *Compare and Contrast Gravitational Forces to Buoyant Forces*
  - **Differentiate between volume and mass. Define density.**
  - **Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits.**
    - *Measure ROV volume and mass to determine density and if ROV will have positive, negative, or neutral buoyancy*

Massachusetts Science and Technology/Engineering Curriculum Framework

Physical Sciences (Chemistry and Physics), Grades 6–8

- **Explain and give examples of how the motion of an object can be described by its position, direction of motion, and speed.**
- **Graph and interpret distance vs. time graphs for constant speed.**
  - *Use ROV to construct speed and acceleration graphs*

Massachusetts Science and Technology/Engineering Curriculum Framework

Physical Sciences (Chemistry and Physics), Grades 6–8

- **Differentiate between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.**
  - *Potential energy within the motors transform into kinetic energy in the propellers and ROV*

Massachusetts Science and Technology/Engineering Curriculum Framework

Technology/Engineering, Grades 6–8

- Materials, Tools, and Machines
  - **1.1 Given a design task, identify appropriate materials (e.g., wood, paper, plastic, aggregates, ceramics, metals, solvents, adhesives) based on specific properties and characteristics (e.g., strength, hardness, and flexibility).**
  - **1.2 Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.**
  - **1.3 Identify and explain the safe and proper use of measuring tools, hand tools, and machines (e.g., band saw, drill press, sander, hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) needed to construct a prototype of an engineering design.**

Massachusetts Science and Technology/Engineering Curriculum Framework

- Engineering Design
  - **2.1 Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.**
  - **2.2 Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic projections, multiview drawings.**
  - **2.3 Describe and explain the purpose of a given prototype.**
  - **2.4 Identify appropriate materials, tools, and machines needed to construct a prototype of a given engineering design.**
  - **2.5 Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.**

Massachusetts Science and Technology/Engineering Curriculum Framework

Communication Technologies

- **3.1 Identify and explain the components of a communication system, i.e., source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.**
  - *Describe how ROVs are used for mapping ocean floor using sonar*
- **3.2 Identify and explain the appropriate tools, machines, and electronic devices (e.g., drawing tools, computer-aided design, and cameras) used to produce and/or reproduce design solutions (e.g., engineering drawings, prototypes, and reports).**
  - *Potential use of computer programs for design of ROV*

Massachusetts Science and Technology/Engineering Curriculum Framework

Manufacturing Technologies

- **4.1 Describe and explain the manufacturing systems of custom and mass production.**
- **4.2 Explain and give examples of the impacts of interchangeable parts, components of mass-produced products, and the use of automation, e.g., robotics.**
- **4.3 Describe a manufacturing organization, e.g., corporate structure, research and development, production, marketing, quality control, distribution.**
- **4.4 Explain basic processes in manufacturing systems, e.g., cutting, shaping, assembling, joining, finishing, quality control, and safety.**

Massachusetts Science and Technology/Engineering Curriculum Framework

Transportation Technologies

- **Identify and explain lift, drag, friction, thrust, and gravity in a vehicle or device, e.g., cars, boats, airplanes, rockets.**

ROV Unit

ROV Unit Successes

- Increased Student Engagement
- Building Cooperative Team Working Skills
- Exposes students to current and applicable technological subject matter
- Covers 21 Standards in the *Massachusetts Science and Technology/Engineering Curriculum Framework*
- Increased my knowledge of Technology and Engineering

ROV Unit

ROV Unit Obstacles

- SNOW DAYS
- Student Absences

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

Application Form

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

Name_____

Title_____

School/Organization_____

School/Organization Address_____

City_____State_____Zip_____WK Phone ( )_____

Home Address_____

City_____State_____Zip_____

HM Phone ( )_____ Cell Phone ( )_____

E-mail_____FAX ( )_____

Administrator Name _____

Title_____

E-mail_____ Phone ( )_____

FAX ( )_____

Local MATE/ITEST Contact: _____

E-mail_____

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

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

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

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

_____
_____
_____
_____

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

_____
_____
_____
_____

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

_____
_____
_____
_____

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

_____
_____
_____
_____

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

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

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

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

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

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

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

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

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

Please provide some background information on your school or organization.

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

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

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

☐ No
☐ Yes – please specify _____

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

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

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

_____
_____
_____

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

_____
_____
_____
_____

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

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

OR FAX TO: (727) 894-6821

OR EMAIL TO: emoulton@marinetech.org

The 1st Annual MATE Center ITEST Summer Institute

Basic Level ROV Building for Classroom Projects

July 12th – July 18th 1st, 2010

DAY 1- Monday, July 12th

TIME	ACTIVITY	LOCATION
1:00 pm	Trip to Monterey Bay Aquarium (OPTIONAL) Van pick –up at 1:00 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- Tuesday, July 13th

TIME	ACTIVITY	LOCATION
8:00 am	Van leaves from Monterey Bay Lodge to travel to MPC	MPC- Life Sciences LS 101
8:15 am – 8:30 am	Breakfast (coffee and pastries)	
8:30 am – 9:00 am	Welcome, introductions, logistics, and goals for the week– **Erica Moulton (MATE)**	
9:00 am-9:45 am	**Goals for the week & Introduction to ROVs- Matt Gardner (MATE)**	
9:45 am -10:45 pm	**ROV in a Bag- Matt & Erica**	
10:45 am – 11:00 am	Break	
11:00 am – 12:00 pm	**ROV in a Bag- motor placement exercises**	
12:00 pm – 12:45 pm	Lunch	
12:45 pm -1:00 pm	**Frame design, materials and methods : What is typically used and why**	MPC - Auto Technology Lab and Auto Technology Classroom
1:00 pm -1:15 pm	**Symmetry of a frame, purpose of a frame, and discussion of what our ROV will do at the end of the week- the mission!**	
1:15 pm -2:45 pm	**Group frame building**	
2:45 pm – 3:00 pm	Break	
3:00 pm -5:30 pm	Frame building and testing.	
5:30 pm -6:00 pm	**Biophobia activity**	

6:00 pm	Dinner	

DAY 3- Wednesday, July 14nd

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 - Auto Technology Lab and Auto Technology Classroom
8:30 am – 10:00 am	**Incorporating ROVs into your curriculum- Joe Slovacek (Cerro Coso Community College, Mathematics professor)**	
10:00 am – 11:00 am	Basic Circuit demonstration- Tom Rebold (Monterey Peninsula College, faculty)	
11:30 am – 12:30 pm	Workforce Development & The MATE Center- Deidre Sullivan (MATE Center, Director)	
12:30 am – 1:30 pm	Lunch	
1:30 pm -2:30 pm	Electricity! Electrical safety, basic electricity, how a switch operates and the use of a multimeter	
2:30 pm – 3:30 pm	Soldering workshop	
3:30 pm – 4:30 pm	Electrical Troubleshooting- What to do when things go wrong.	
4:30 pm – 6:00 pm	Building your ROV control box	
6:00pm – 9:00 pm	Pizza Dinner & Lab time	

DAY 4- Thursday, July 15th

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 - Auto Technology Lab and Auto Technology Classroom
8:30 am - 10:30 am	Flotation & Bollard discussions, demonstrations and practice	
10:30 am- 11:30 am	Wiring up the frame & attaching motors	
11:30 am - 12:30pm	Team management discussions: tethers, pilots and missions.	
12:30 pm – 1:15 pm	Lunch	
1:15 pm - 1:45 pm	Drive to MBARI	Monterey Bay Aquarium Research Institute (MBARI)
1:45 pm -3:00 pm	MBARI vehicles- **Bill Kirkwood & George Matsumoto– (MBARI)**	

3:00 pm -5:00 pm	MBARI tour **Bill Kirkwood (MBARI)** SCINI ROV demonstration Bob Zook (**MLML**) & DJ Osborne (**MBARI**)	www.mbari.org
5:00 pm -5:30 pm	Tour the vessels **Knute Brekke (MBARI)**	
5:30 pm -6:15 pm	Vans return to hotel - dinner	

DAY 5- Friday, July 16th

TIME	ACTIVITY	LOCATION
8:00 am	Van leaves from Monterey Bay Lodge to travel to MPC	MPC- Auto Technology Lab
8:15 am – 8:30 am	Breakfast (coffee and pastries)	
8:30am -9:45 am	**Simple manipulators**	
9:45 am -10:00 am	Break	
10:00 am -11:00 am	**ROV Competitions- Jill Zande (MATE Center, Associate Director and Competition Coordinator)**	
11:00 am – 12:00 pm	**ROV Building**	
12:00-1:00 pm	Lunch	
1:00 pm – 6:00 pm	ROV Building	
6:00-9:00	Lab and building time available Auto Tech cookout hosted by Matt & Jeremy	

DAY 6- Saturday, July 17th

TIME	ACTIVITY	LOCATION
8:00 am	Van leaves from Monterey Bay Lodge to travel to MPC	MPC Auto Technology Lab 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 Auto Technology

7:00 pm- 10:00 pm	Closing dinner and team presentations	Lab MPC Library – Sam Karas Room

Day 7- Sunday, July 18th

TIME	ACTIVITY	LOCATION
10:00 am	Check out of Monterey Bay Lodge	Heading home ☺

NOTES FROM THE MEETING INSERTED INTO AGENDA, WHICH IS FOLLOWED BY THE PARTICIPANT LIST

Attachments:
- **Tami's ppt**
- **Erica's list**
- **Jill's ppt**
- **ITEST Year 1 regional coordinator's ppts**
- **Candiya's ppt and handout**

2010 MATE Regional Coordinators' Meeting
September 24th, 2010
8:00am – 5:00pm
University of Washington
Ocean Sciences Building
Room 203

This is OUR meeting – and our time to share and discuss our triumphs and challenges. While it may not be explicit, you are always welcome and encouraged to contribute to discussions as well as to present your own questions and concerns. Collectively, we can find solutions!

8:00am: Breakfast

Sweet (pastries, jams and jellies) as well as savory (eggs, potatoes) breakfast items will be available.

8:15 – 8:30am: Welcome and introductions (continue eating!)

COMPETITION

8:30 – 9:45am: General competition topics

Each of these topic areas represent a time for you to bring up your questions and concerns.

- **What does it take to be a MATE regional?**

With the addition of the Japan regional, we are now at 20! However, there may be a problem with the Nova Scotia regional. Nova Scotia Community College can no longer coordinate the event. MATE is looking for a new host.

The MATE ROV competition network continues to grow! As new regions express interest in developing a regional contest, these are the core requirements and elements that make a regional "MATE."

MATE will create banners for each regional. Be sure to check the name of your regional as it appears on the regional contests' web page – Jill will make the banner based on the names as they appear here.

- Attend a regional/international event or field a team that participates

- Follow the rules and specifications, especially when it comes to building props

  MATE will create a more step-by-step set of prop-building instructions as well as a shopping list of prop parts organized by task then summarized into one long list. The list will include the estimated cost to build one set of props and will point out where old props can be reused or recycled.

  Consider prop-sharing with other regionals (e.g. Florida, Southeast, and Carolina share).

  Make it a point to participate in (or at least listen to the archive of) the prop-building conference call. DO NOT wait until the last minute to build props! If you cannot find a part or are having other troubles, call MATE (Matt!).

  Need help building props? Ask a nearby EXPLORER team or involve the parents of your competitors. You might consider offering props as a prize to your regional winner(s).

- Regionals are held at least 6 weeks in advance of the international competition date

  Preference is that regionals don't take place until April BUT they CANNOT take place within 6 weeks of the international competition date. Having a regional this close to the international competition makes it very difficult for your regional winners to get the necessary permissions and make travel plans.

- Follow evaluation protocol/administer surveys

  In addition, please have media releases and liability waivers signed by participants. MATE is working to combine these into a one-pager that you can customize for your regional. This template will be posted on the back-end of your regional contest web site.

- Manage your regional contest web site, which includes posting scores/results

  Tools that MATE can provide to make this easier include a master score sheet template as well as a Flickr account (for posting photos).

  Some teams are concerned that others will see their scores and have an "advantage." To address their concerns, you can wait to post your regional scores until the Monday after the last regional event. Make sure to note on your regional web site that the posted scores are "relative" to your regional event. This is important since some regionals have only one other requirement (such as posters) in addition to the mission and/or some regionals may not have all of the props or a prop may fail so the scores do not reflect the full scale of the international event.

  Copy your event score sheets! Keep the copy and mail the originals out to your teams. They deserve to see them and, hopefully, will learn from them.

  If possible, please provide your winning regional team with some "concierge" services to get to the international. For example, help direct them to potential

fundraising sources, make sure that they understand all of components of international event, etc.

The consequence of not following these requirements is that the regional winners are not invited to move on to the international competition.

Summary of upcoming additions to the back-end of regional web sites:

- Master score sheet template
- Sample event-day schedules
- Media/liability template
- Safety checklist (see below for safety discussion)
- Certificate of participation that can be customized for each regional (see below)
- Flickr access to post photos

- **Lessons learned from 2010**

Jill gave a brief history on how MATE missions are created – that is, real-world events are modeled and engineers, technicians, and scientists in that field of study are consulted.

This session will focus on lessons learned and how to implement them. It will also ask for feedback on new practices implemented in 2010 and suggested changes for 2011.

- Safety

Stress safety! It is a big part of the event always, but will be particularly important during the international event at the NBL.

Things that MATE will do to help with this:

- Develop a more detailed and specific list
- Focus on safety at the 2011 mentor workshop

Things that you can do to help with this:

- Make sure that you are using qualified people to conduct the ROV safety checks. Think about designating ONE person as the lead safety checker who then "trains" others (if you need more than one).
- Require participants to wear closed-toe shoes at all times and safety glasses when working on the vehicle, etc.
- Hold an engineering review, pool practice day, or some type of pre-event ROV screening (this will give teams time to deal with safety issues before contest day).
    - Pneumatics/hydraulics

Scott Fraser to develop an on-line safety quiz – teams must pass this in order to use pneumatics/hydraulics.

- Eligibility

Eligibility rule change for 2011: ALL RANGER teams must attend a regional event in order to move on to the international competition. International RANGER teams that are not located near a regional event must participate in a demo similar to the current demo requirement for EXPLORER class teams.

If you know of a RANGER team that will experience extreme financial hardship because of travel your regional cannot support them, ask MATE for assistance.

Rule wording change for 2011 – "the number of teams that actually show up on contest day determines the number of winners that move on to the international event." That is, 10 or more individual SCHOOLS competing on contest day = two winners move on to the international competition.

- Elementary schools

Elementary school teams are allowed but only in the SCOUT class. (MATE will start defining eligibility by age instead of grade since some students are home schooled.) To manage the growth that may result, you might consider having your SCOUT event on a separate day. You might also consider having a maximum number of SCOUT registrants – for example, "the first 20 SCOUT teams signed up" get to participate.

Specs rule change for 2011: SCOUT class power will be 12 volts, 15 amps (increased from 7.5 amps).

Regionals are free to allow more than one team per school to participate in each competition class – it depends on whether or not you can accommodate that. If not, suggest to the teacher to run an in-school run-off, with the winner participating in your regional.

Regardless of competition class, individual students can only be on ONE team.

- EXPLORER class

Demo requirement will continue.

Eligibility rule change for 2011: Two teams per school are permitted provided that they come from different departments and/or campuses and there are no common mentors or students (i.e., faculty can only mentor one team and students can only be on one team). Otherwise, the schools will be encouraged to hold run-offs to determine which team represents their school at the international competition.

- Certificates of participation

MATE will create a template that you can customize for your regional. Please offer these to your teams/individuals.

- Other topics to be discussed as their own sessions
  - Judge preparation
  - Mentoring guidance – if they are in the way, over involved- consider having a MUD event at the Regional or have them build your props

We never got to these! MATE will organize future webinars around these topics.

Feedback

- Charging a nominal fee ($50) for competition participation that is then used to fund meals, prizes, etc. (in other words, it goes back to support the teams)

This was a recommendation of MATE's national advisory committee. This "participation fee" will be collected by MATE. RANGER team fees will be returned to the respective regionals (i.e., a regional will receive the fees of the teams that register to participate in it). EXPLORER fees will go directly to supporting the international event. No fees will be collected for SCOUT teams.

Teams will be charged this fee when they register. It will be refunded if they withdraw two weeks in advance of their regional/international competition; if they withdraw within two weeks they lose it.

What this means is that you should, at the very least, plan to provide lunch or snacks and certificates to your participants!

Post-meeting note: MATE can collect and distribute participation fees for regionals held outside the U.S. Jill will be contacting each non-U.S. regional to discuss this.

- Mentor workshop (future topics include safety)
- EXPLORER power (which was first implemented in 2009)
- RANGER class divided up into "new" and "returning" teams?!

Rule wording change for 2011: Officials will only talk to students – not teachers, mentors, or parents – regarding a challenge, concern, when setting up at the mission stations, etc.

- **2011 competition theme and potential mission tasks (Matt Gardner, MATE Center Competition Technical Manager and Head Rules Judge)**

  Matt Gardner will give us a taste of what we're planning for the 2011 mission tasks.

The 2011 theme is focused on Deepwater Horizon oil spill. EXPLORER teams should be reminded that, since we are headed to the NBL, they will be going to 40 feet!

9:45 – 10:30pm: Discussion topics

It's safe to say that we've all experienced an over (or under) involved mentor at one point or another. Besides taking a cue from sports officials ("you're outta here!"), what practices can we put in place to both deal with the situation and encourage a transformation in the way they lead their teams?

- **What does it take to be an effective mentor? (Erica Moulton, MATE Center Summer Institute Coordinator/Florida Regional Coordinator)**

This was tabled for an on-line session. It will also be included as part of the regional coordinators' handbook.

And what resources, information, professional development, etc. can the MATE Center provide to faculty, teachers, informal educators, industry professionals, and parents

leading ROV competition teams? Please be prepared to share your best practices, resources, and ideas.

10:30am: BREAK

10:45 – 11:30am: Discussion topics (continued

The challenge of how to best prepare judges and ensure consistency across the board is not a new one. The competition has made strides over the years (e.g. improved score sheets), but there is room for more.

- **Judge preparation (Dwight Howse, School of Ocean Technology, Memorial University/Newfoundland and Labrador Coordinator)**

This was tabled for an on-line session. It will also be included as part of the regional coordinators' handbook.

Beside score sheets and basic descriptions of the judging duties, what other resources, information, training tutorials, guidelines, etc. can the MATE Center provide to help make preparing judges an "easier" and more uniform process? Please be prepared to share your best practices, resources, and ideas.

11:30am – 12:00pm: Recruiting diverse audiences

Increasing the diversity of the ocean workforce is an overarching goal of the MATE Center as well as a focus of the ITEST grant.

- **Lessons learned from MATE's diversity study (Tami Lunsford, MATE Center Technical Internship Coordinator)**

Jill will send out Tami's ppt presentation. One nugget to share here – please consider adding your photo to your regional web page. Studies indicate a personal touch can make a difference in reaching out to underrepresented audiences.

- **Resources from the ITEST advisory committee (Erica Moulton)**

Jill will send out the list that Erica compiled.

12:00 – 12:30pm: LUNCH

ITEST

12:30 – 1:00pm: ROVER demonstration (continue eating!)
Bruce Ford of Clear Science, Inc. will take us on a tour of ROVER (ROV Education and Resources), the new web site created under MATE's ITEST grant. ROVER will be the new home for MATE ROV competition information and management (think back-end regional contest management).

http://www.rover-itest.us/main/
Please review the site and send feedback to Jill to share with Bruce. Also, do you have any ROV words/terms? We are creating a glossary of terms, so send them to Jill. Jill will also send Bruce the glossary from the MATE textbook!

A regional coordinators' "wiki" was also discussed. Wes Thompson is looking into how a wiki could be used to work on the regional coordinator's handbook as well as the middle school curriculum (see discussions below).

1:00 – 1:30pm: ITEST grant year 1 overview (Jill Zande)

After a brief reminder of our ITEST grant goals, the presentation will focus on first year of ITEST activities. What did we accomplish?

A lot! Jill will send along her ppt presentation.

1:30 – 2:45pm: ITEST grant year 1 regionals reporting

Each of the four regions that implemented ITEST grant activities in year 1 will share their "stories" (including triumphs, challenges, and lessons learned) of recruitment, professional development, student outreach, and competition events.

Jill will send out ppts – see also the ITEST annual report.

A few highlights:

- College (or high school) students as mentors (paid or unpaid) was successful (on both sides!).
- Soldering was an issue across the board! Special attention (workshops) needed!
- Many teachers couldn't believe that the stuff was free and/or that they didn't have to give it back!

2:45 – 3:00pm: Recruiting for the ITEST beginner-level Summer Institute (Erica Moulton)

Erica will present our improved recruitment strategy based on lessons learned in grant year 1 and ask for your input and ideas for ensuring a full-house at the 2011 Summer Institute.

If you are implementing ITEST activities in 2010/2011 – you will have 5 spots available for your regional teachers at MATE's Beginner Summer Institute. Erica will develop a letter that you can provide to your potential participants that they can then share with their principals/administrators. Please make sure to tell them NOW about the summer institute before they book their summer vacations. Encourage them to attend!

Other ideas to improve Summer Institute participation included holding it at the same time each year and either right after or right before the school year.

3:00 – 3:15pm: Career component (Deidre Sullivan, MATE Center Director)

Take a look at OceanCareers.com, mappingyourfuture.org, CHOICES.edu, Bridges.com, and www.schoolwires.com. Send comments, ideas, and feedback to Deidre (dsullivan@mpc.edu) to help inform the development of the middle school on-line career tool.

3:15pm: BREAK (coffee, soda, cookies)

3:30 – 4:30pm: ITEST evaluation (Candiya Mann, MATE and ITEST grant evaluator, Washington State University)

Candiya will present her findings from grant year 1 as well as review the evaluation tools and timeline. "Easy" and effective ways of collecting demographic information will be a focal point of discussion.

Jill will send out Candiya's ppt and handout.

Candiya will create an "evaluation highlights" that includes anecdotal parent/educator survey quotes and can be used in your advertising and recruitment.

If you have any success stories to share from your region, please them send to Candiya/MATE.

4:30 – 5:00pm: Middle school curriculum (DeDee Ludwig, Shedd Aquarium/Midwest Regional Coordinator)

The draft curriculum will be sent in advance. DeDee will give an overview and invite questions and feedback.

The draft is making its way around. Please send comments, feedback, ideas, and suggestions (e.g. add a tool list, ppts that complement the material, curriculum modules developed by New England's student mentors, Ike's engineering presentation) to DeDee (dludwig@sheddaquarium.org) using MS Word and "track changes." The goal is to get a "working draft" by late November to use in Year 2 ITEST activities. Candiya will develop a survey tool so that we can collect feedback from the teachers who use it.

OTHER TOPICS

5:00 – 5:30pm: Upcoming events and robotics news

- Nova Scotia regional

See above.

- Competition handbook
- Forum on Robotics Education

Jill attended the one-day forum in Denver in August. It was organized by the Association for Unmanned Vehicle Systems International (AUVSI) Foundation. The Foundation is trying to bring together robotics programs and competitions to share news and ideas, best practices, develop collaborations, etc.

Plenty of the attendees talked about specific platforms and are advocating for a common platform. Jill noted that MATE doesn't require or advocate for any one platform – that is up to the teams and their creativity!

  - Partnering with other robotics programs

New England's partnership with BEST Robotics as well as with the Boys & Girls Club is a great example.

You might consider at least connecting with other programs in your area if only to avoid schedule conflicts.

- iRobot's National Robotics Week

April 9 – 17, 2011. If your regional is being held during that time, let Jill know so that she can get it on the robotics week calendar.

- Boy Scouts of America robotics merit badge

The badge will be launched during National Robotics Week. MATE is working with the Boy Scouts to make sure that underwater robots/the MATE competition is highlighted as a way that Scouts can achieve this badge.

- American Society for Engineering Education (ASEE) conference

The 2011 conference is being held in Vancouver, BC Canada June 26 – 29, 2011. Tom Consi is organizing a special session on MATE. MATE will also exhibit.

- Other news?

5:30pm: Plans for next year's meeting and FINITO!

The 2011 Oceans conference is in Kona in late September. Deidre will do a cost analysis to see if MATE can justify having next meeting there!

7:00pm: Dinner at Ivar's

Ivar's Salmon House on Lake Union
401 N.E. Northlake Way
Seattle, WA 98105

Dinner was delicious!

PARTICIPANTS

1) Jill Zande (MATE/Monterey)
2) Matt Gardner (MATE/Monterey)
3) Dwight Howse (NL)
4) Sharon Gilman (Carolina)
5) DeDee Ludwig (Shedd)
6) Erica Moulton (MATE/FL)
7) Scott Fraser (SoCal)

8) Sarah Waters (Great Lakes)

9) Rick Rupan (PNW)

10) Fritz Stahr (PNW)

11) Deidre Sullivan (MATE)

12) Candiya Mann (MATE/ITEST evaluator)

13) Kyra Kester (ITEST evaluator)

14) Peter Leighton (Mid-Atlantic)

15) Meghan Abella-Bowen (New England)

16) Cindy Fong (Big Island)

17) Darryl Watanabe (Big Island)

18) Wes Thompson (PNW)

19) Tom Consi (Wisconsin)

20) Jody Patterson (Gray's Reef SE)

21) Eric Baker (Pennsylvania)

22) Ike Coffman (Texas)

Members of the MATE ITEST Project's Curriculum and Cultural Advisory Committee

- Jenny De La Hoz, Community Partnerships Program Manager at the Monterey Bay Aquarium (MBA)
- Kimberly Swan, former middle school classroom teacher and current Teen Programs Manager at MBA
- Cindy Fong, science teacher at Hilo Intermediate School
- Pascale Pinner, teacher-in-residence and grant writer at Hilo Intermediate School
- Katie Welsh, Associate Professor in the College of Education at the University of Wyoming whose focus areas are multicultural and K-8 math and science education
- Céleste Frazier Barthel, Science Connections Coordinator and Ph.D. candidate in the Department of Science Education/Geosciences at Oregon State University
- DeDee Ludwig, Educator and Curriculum Development Specialist at the John G. Shedd Aquarium