

# MATE ROV Competition: Challenging students to develop technical and 21<sup>st</sup> century workplace skills

Jill Zande

Associate Director & Competition Coordinator, MATE Center

Chair, Marine Technology Society (MTS) – Monterey Bay section



# MATE COMPETITION PHILOSOPHY

The MATE ROV competition is about **student learning**.

It is designed to be an educational and inspirational event for **students** that challenges them to apply the physics, math, electronics, and engineering skills they are learning in the classroom to solving practical problems from the marine workplace.

Mentors (teachers, parents) are expected to limit their input to educational and inspirational roles and encouraged to focus on benefits to the **students** from the learning process and not simply “winning” the competition.



# BACKGROUND

## Partnering with the MTS ROV Committee to...

- **Address shortage of skilled individuals to support the marine industry**

- Reach more students & get them interested in the industry
- Help students develop the skills to support marine activities



- **Provide a venue for industry to become involved with education**

- Funds – to support student participation
- Industry mentors – complement & expand students' & educators' knowledge and expertise



MATE



marine technology  
SOCIETY

Opportunity runs deep™

# TO DATE...

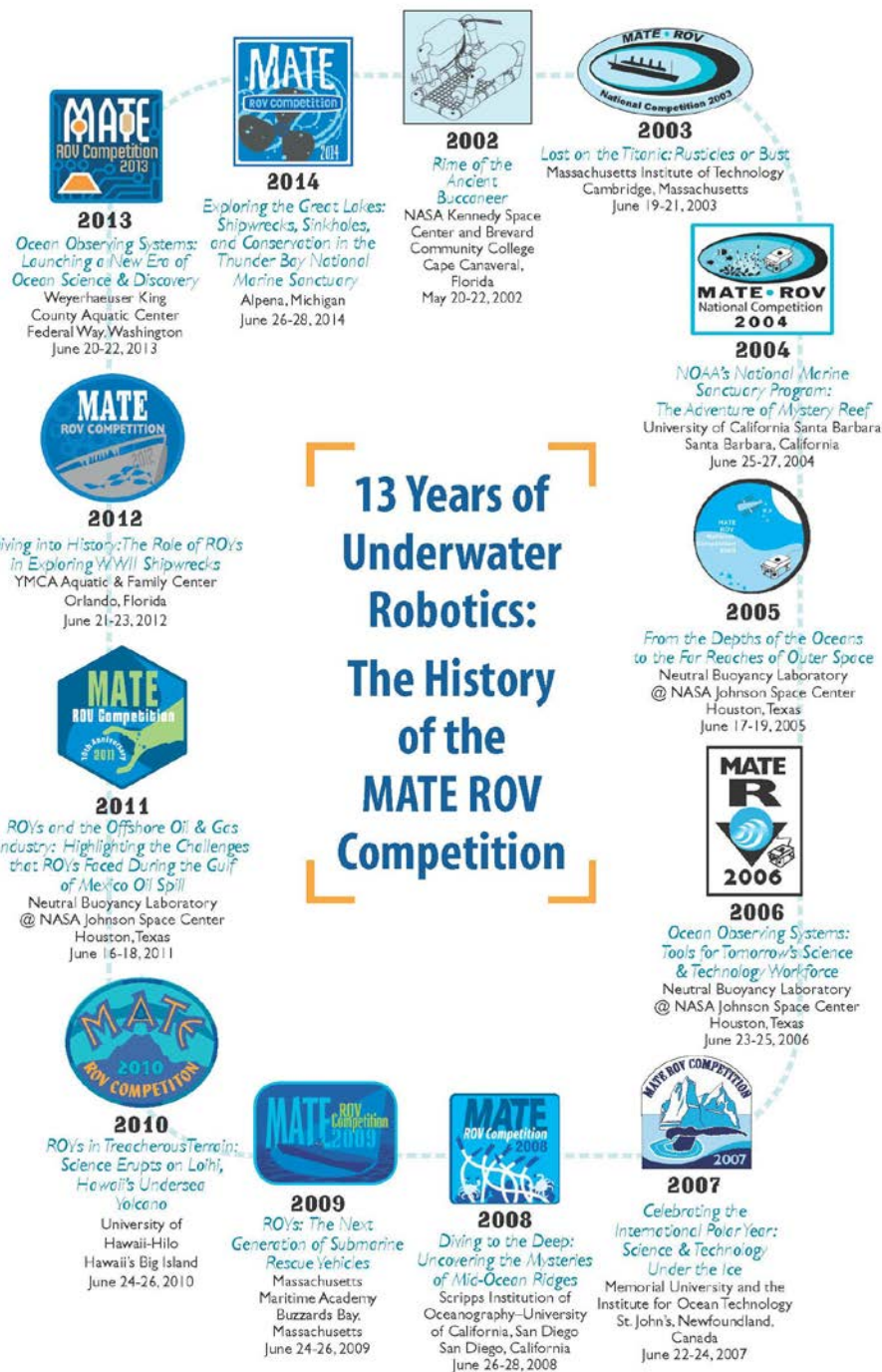
- Has involved well over 10,000 students in grades 4-16 who work in teams to tackle missions based on the ocean STEM workplace
- Includes one international competition and a network of 23 (and growing!) regional contests
- Involves 100s of working professionals & organizations
- Includes underwater missions and technical reports, engineering presentations, and poster displays
- Gets students excited about STEM and motivates them to problem-solve, think critically, manage a project, and work together as a team
- Is encouraging students to pursue STEM degrees and jobs in the field



***2014 marked the 13<sup>th</sup> international competition!***



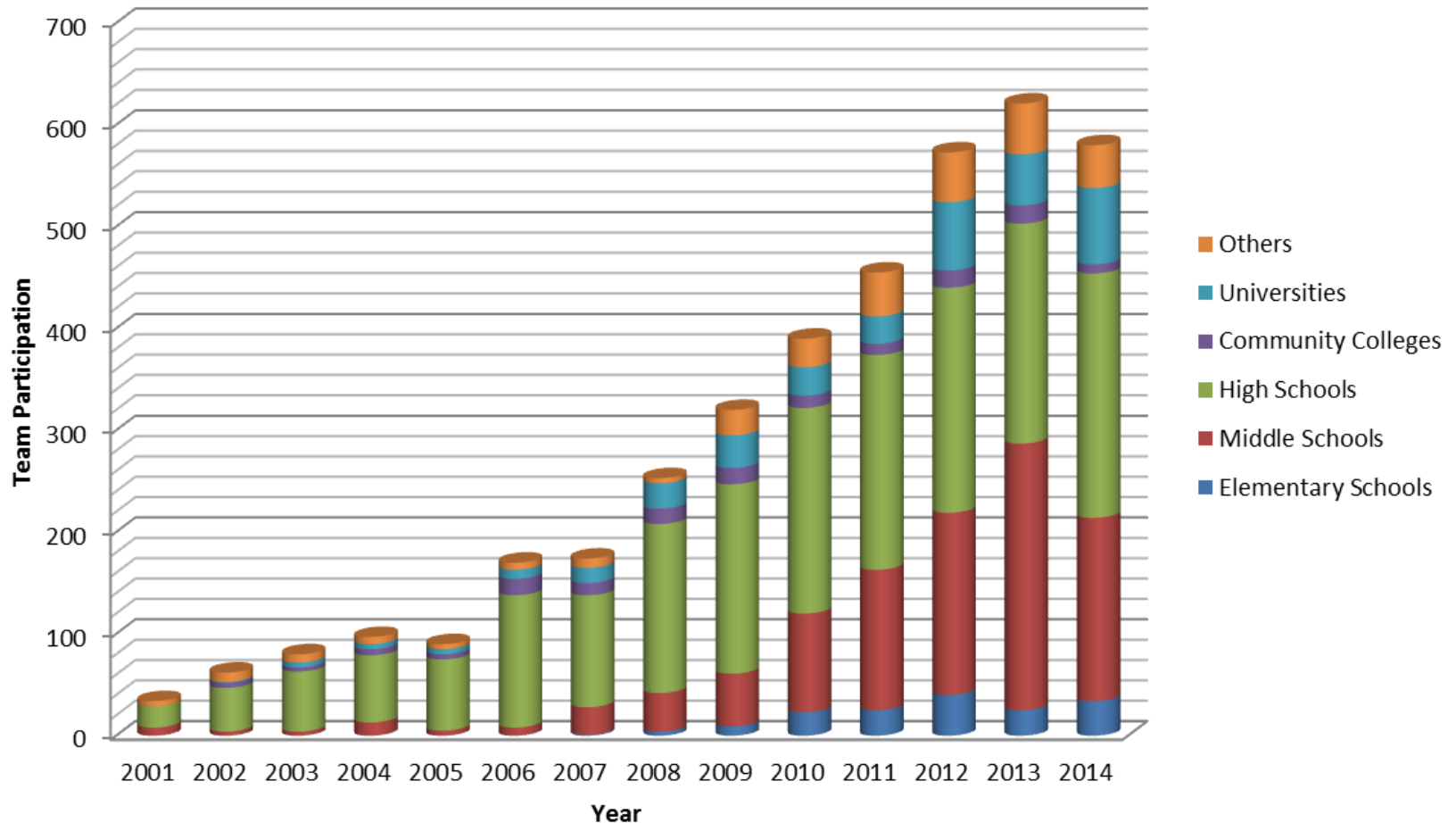




# 13 Years of Underwater Robotics: The History of the MATE ROV Competition

# COMPETITION REACH

## MATE ROV Competition Team Participation 2001-2014



# MATE Regional ROV Competition Network

The MATE Competition Network began in 2001 and currently consists of 24 regional events that take place across the U.S. and around the world.

Use this information to find the regional event near you!



## MATE International Regional Competitions:

Canada (Newfoundland & Labrador and Nova Scotia), Egypt, Hong Kong, Japan, Scotland, Russia







13th Annual

# MATE International ROV Competition



## A SPECIAL THANKS TO ALL OF OUR SPONSORS!



MATE



marine technology  
SOCIETY

Opportunity runs deep™



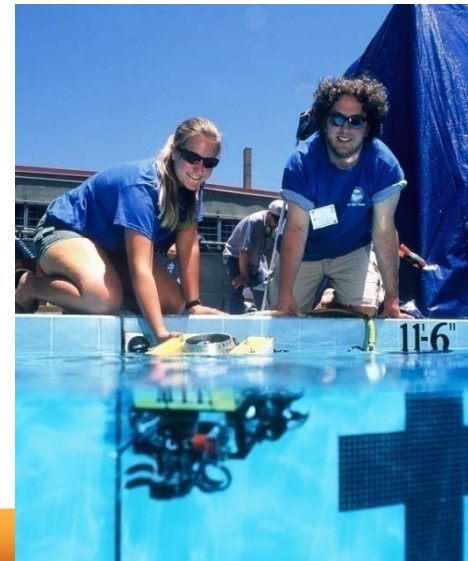
# COMPETITION STRUCTURE

The competition is divided into 4 classes that vary depending on the vehicle specs & complexity of the mission tasks:

- **EXPLORER** (advanced)\* (vehicle demonstration required)
- **RANGER** (intermediate)\*+ (participation in regionals required, some exceptions)
- **NAVIGATOR** (beginner/intermediate) +
- **SCOUT** (beginner)+

*\*these classes participate in the international competition*

*+these classes participate in the regional contests*



# COMPETITION STRUCTURE

- **EXPLORER**

- 48 volts, 40 amps
- Camera required

- **RANGER**

- 12 volts, 25 amps
- Camera required

- **NAVIGATOR**

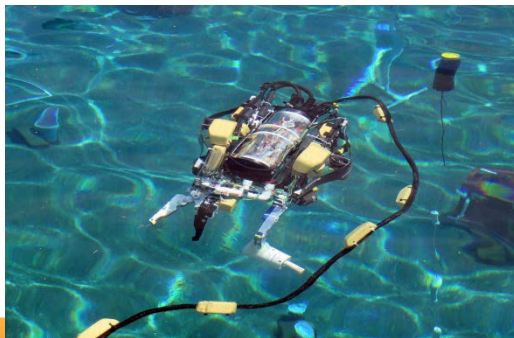
- 12 volts, 15 amps
- Camera required

- **SCOUT**

- 12 volts, 15 amps
- No camera required

- **OVERALL**

- “Platform” of your choice
- Must have a fuse, follow safety protocol, and pass a safety inspection
- No onboard electrical power
- Fluid power is permitted – see detailed specs for more information
- No limit on building materials, but they must not damage the pool



# SAFETY

## Pre-competition:

- EXPLORER class demonstration requirement
- Pneumatics/hydraulics quiz
- Technical report safety review
- Safety inspection
  - Inspection sheet specific to each class posted online
  - Tutorial posted online walks safety officers and teams through each line item on the sheet

## At the event:

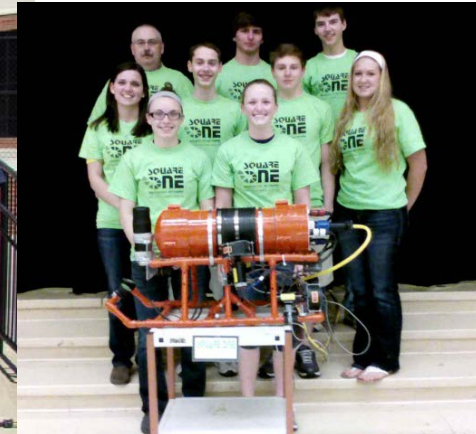
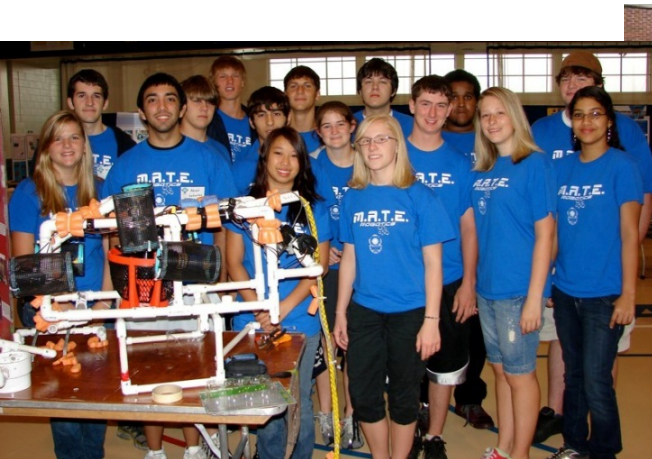
- EXPLORER demonstrations
  - Company spec sheets and schematics due to the MATE Center 2 weeks before demo
  - Reviewed by MATE safety inspectors
- Safety inspections
  - Dedicated safety officer(s)
  - Improved and expanded info and training
  - Process used at the international as an example
    - System of red, yellow, and green cards/flags
    - Involve mission judges





# ***“Think of yourselves as entrepreneurs”***

- Emphasize applying skills in new & innovative ways, working as part of a team, & understanding the breadth of business operations
- Challenge students to form companies and structure them with the personnel necessary to design, build, perform, & “sell” their product
  - Who is the company CEO and CFO?
  - Who manages government and regulatory affairs?
  - Who is responsible for R&D? Systems engineering? Operations?
  - Who handles marketing and media outreach?

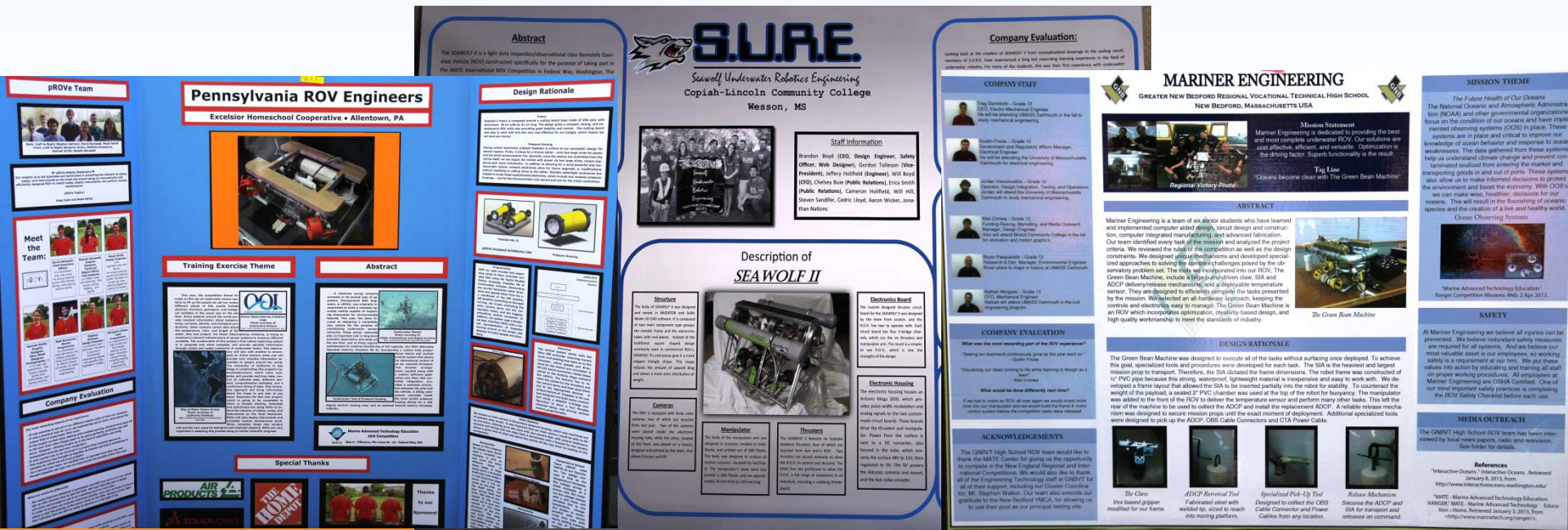




# REQUIRED "PRODUCTS"

## Engineering & Communication component includes:

- "Technical storytelling"
- Technical reports & company spec sheets
- Engineering presentations
- Poster displays & (international only) media outreach kit



# REGIONAL REQUIREMENTS

- Teams must prepare and submit at least 2 of the 3 engineering & communication components
- Whatever component is not required, regionals are encouraged to offer the winning team(s) a chance to submit it for review and feedback before the international event
- Teams must prepare and submit (in advance) a company spec sheet AND schematics for the safety inspection



# Company names, logos, & tag lines

- Global Ocean Exploration Systems  
*Providing, surveying, sampling, and completion of underwater tasks around the world*
- Endeavor Enterprises
- Triton Technologies
- 4-D Oceanus – *A subsidiary of O'Donel High School*
- Nimitz Marine Recovery Unit





# Marketing materials

- Brochures
- Business cards
- “Swag” – pens, lapel pins, stickers
- One company developed an “app” that is available on the iTunes store

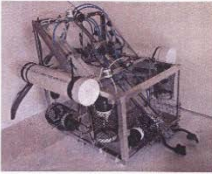


**APTOS  
MARINERS  
ROBOTICS,  
LLC.**


**Experts in Deep Water  
Research, Repair, and  
Recovery**

**ABOUT US**  
We are Aptos Mariners Robotics, LLC, and we are experts and innovators in deep water research, repair and recovery. Our diverse team of employees is proficient in engineering, software design, and deep water operations. The recent Deepwater Horizon oil spill disaster in the Gulf of Mexico validates the importance of being prepared to detect, prevent or rapidly repair a crippled deep water oil rig. We designed our ROV, the *Mariner I*, to demonstrate our capabilities with a simulated deep water oil rig disaster. Our ROV will repair, cap and shut off a simulated broken oil well, will gather samples of marine life, and will collect oil samples at specific ocean depths. The primary elements of our ROV are speed, maneuverability, and our retractable mechanical arm and claw. To ensure maximum visibility under water, we installed four cameras located in strategic positions to facilitate our mission. To propel our ROV we installed eight 4,731 LPH bilge pumps with modified propellers for increased speed and maneuverability. To control our ROV, our software team designed a program that allows us to use an Xbox 360 game controller to operate and manipulate our ROV. The key feature of our ROV is our mechanical claw, which uses a solenoid controlled pneumatic actuator to extend, retract and grab targeted items. We developed an innovative suction device that is also operated by a pneumatic actuator to collect oil samples. Our ROV will allow us to demonstrate that we are the best company to accomplish deep water tasks.


**OUR CREDENTIALS**  
Combined, our team of experts has over 30 years of underwater robotic experience! Our hands-on team is comprised of a wide range of expertise; from structural and mechanical engineering, to knowledge of pneumatics, servo motor technology, and underwater visual instrumentation. We also have an in-house software and hardware design and programming team. We are solutions oriented and enjoy the challenge of creating underwater robots to solve complex deep water problems.

**OUR EQUIPMENT**  



**The Mariner I**




**Robotic Claw**




**xBox Controller & Software**




**Cameras**



**Propulsion**



**Sucking Device**



**Pneumatics**

Special Awards:

- Third Place overall at the 2010 International MATE Competition
- First Place Mission Component at the 2010 International MATE Competition – Perfect score, plus four minutes under time!
- First Place – 2010 MATE Regional Competition, Monterey
- Third Place – 2009 MATE Regional Competition, Monterey

Aptos Mariners Robotics, LLC



**Connor Munger**  
President

100 Mariner Way  
Aptos, CA 95004  
Phone: 831 688-6565  
connormunger@yahoo.com

Aptos Mariners Robotics, LLC



**Adam Simko**  
Lead Engineer

100 Mariner Way  
Aptos, CA 95004  
Phone: 831 688-6565  
trumpetwiz777@msn.com

Aptos Mariners Robotics, LLC



**Gabi Lopez**  
Director of Marketing

100 Mariner Way  
Aptos, CA 95004  
Phone: 831 688-6565  
gabizenithemag@sbcglobal.net



# Creative approaches to technical reports

## Georgia Robotics Technologies



## Georgia Institute of Technology Savannah, Georgia

Chief Executive Officer:  
Michael Tam

Chief Financial Officer:  
Michael Tam

Mechanical Systems Co-Design:  
Michael Bunch  
Evelyn Kim

Electrical Systems Design:  
Phillip Cheng

Software Design:  
Nicholas Parham  
Human Interface Design:  
Brian Redden  
Dive Master:  
Patrick Lizana  
Dive Operations:  
Cameron Schriner

Mentors:  
Dr. Fumin Zhang  
Steven Bradshaw  
Lisa Hicks  
Spencer Burch  
Brandon Groff

## Note from the CEO

Although Georgia Robotics Technologies is only in its third year, as the new CEO of GRT, I'm excited to bring the newest in GRT's robotics lineup to the market - the ROV Beta II.

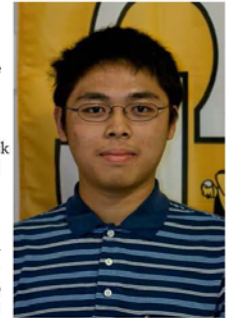
For three years GRT has brought the newest in underwater robotics technology to the market - introducing new systems like wireless control systems, intuitive joystick control, flight safety envelopes, onboard control interpretation, fail safe modes, and the best in structural foundations. As the new head of GRT I promise to continue delivering the front line technology you've come to trust and depend on.

This year's ROV Beta II (ROV Beta Mark II) offers additional redundancies, simplified control systems, easy to maintain manipulators, and highly efficient power systems for prolong runtime. As always the ROV Beta II continues to be built with top of the line components from National Instruments, National Semiconductor, Texas Instruments, Castle Creations, SeaCon, and Crust Crawlers. GRT products sacrifice nothing for the very best.

As always - Georgia Robotics Technologies and all of the employees here wish you the very best with our new ROV Beta mark II.

The leading wave - Georgia Robotics Technologies

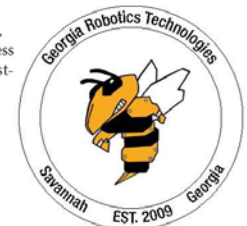
Michael Tam  
Chief Executive Officer  
Georgia Robotics Technologies  
mtam77@gatech.edu



As the foremost underwater robotics venture in the southeastern United States, Georgia Robotics Technologies is located in Savannah, Georgia. With easy access to oceanic fronts, and other testing facilities, our products undergo constant testing and improvement in order to bring you the pinnacle of underwater robotic technology.

## Photo on cover:

Image of ROV Beta during completed testing stages.



# Marketing pitch

Engineering presentations delivered as marketing pitches designed to their product (and personnel) to the “client”



# TIMELINE/COST/RESOURCES

- **Competition timeline**

- ▶ Mission briefing released in September
- ▶ Specs and missions released in November
- ▶ Registration opens December 1st
- ▶ Regional contests in April & May
- ▶ International competition in June

- **Registration fees**

- ▶ No fee for SCOUT or NAVIGATOR
- ▶ \$75 for RANGER & \$100 for EXPLORER\*

- **Resources**

- ▶ MATE web site ([www.marinetech.org/rov-competition-2/](http://www.marinetech.org/rov-competition-2/))
  - ▶ Teams only area, FAQs board, tech help forums
- ▶ Workshops, mentors, travel stipends, etc.

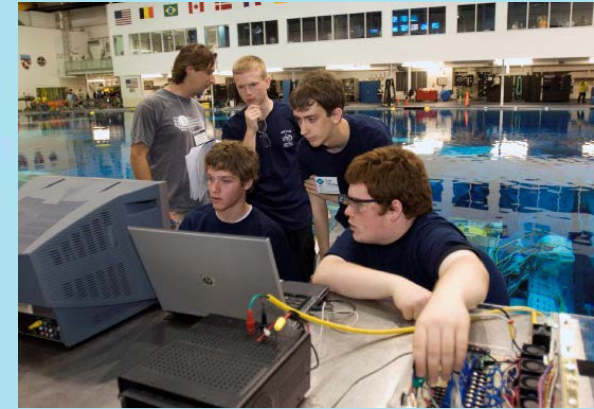
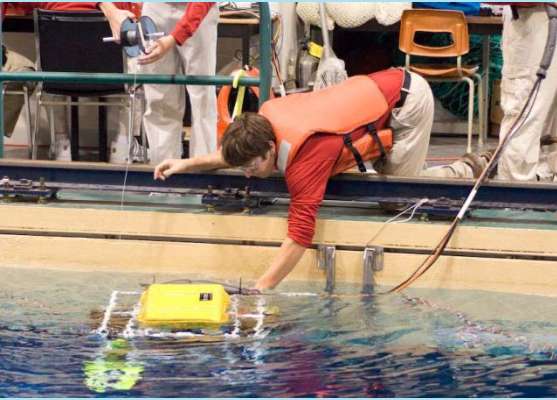
\*some regionals waive fees





The MATE Center and its  
COSEE partners  
present

# Ocean Career Expo

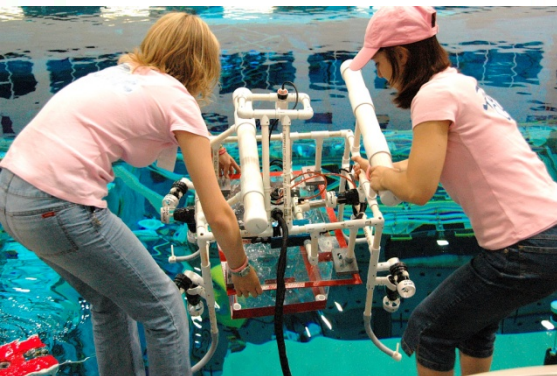
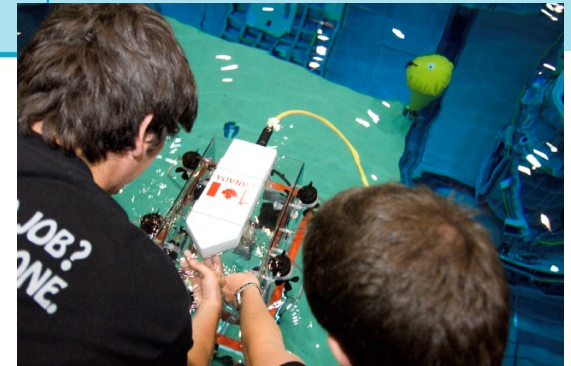


being held in  
conjunction with

## *MATE's International ROV Competition*

The *Ocean Career Expo* is  
designed to:

- ▼ Highlight ocean career opportunities
- ▼ Connect students with employers
- ▼ Help employers find skilled employees





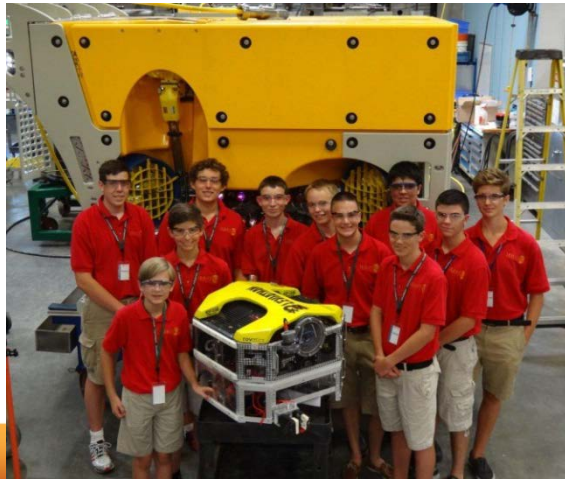
# RETURN ON INVESTMENTS

## High school students have...

- Used the MATE competition as the focus of college entrance essays
- Gone on to pursue engineering or technical degrees at MIT, UNC-Charlotte, Purdue University, US. Naval Academy, and others
- Been awarded scholarships or internships as a result of their participation in the ROV competition

## College students have...

- Gone on to work at research facilities like WHOI and MBARI
- Been hired by companies like Oceaneering, Schilling Robotics, SeaTrepid, VideoRay, and more



## Questions?

Jill Zande  
MATE Center  
980 Fremont Street  
Monterey, CA 93940  
jzande@marinetech.org  
(831) 646-3082  
[www.marinetech.org](http://www.marinetech.org), [www.mtsociety.org](http://www.mtsociety.org)

