

# 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 17,000 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 30 (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
- Was featured in a book, documentary, and Hollywood movie

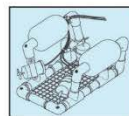


***2017 marked the 16<sup>th</sup> international competition!***





# The History of the MATE ROV Competition



**2002**

*Time of the Ancient Buccaneer*  
NASA Kennedy Space Center  
and Brevard Community College  
Cape Canaveral, Florida  
May 20-22, 2002



**2010**

*ROVs in Treacherous Terrain:  
Science Erupts on Loihi,  
Hawaii's Undersea Volcano*  
University of Hawaii-Hilo  
Hawaii's Big Island  
June 24-26, 2010



**2003**

*Lost on the Titanic: Rusticles or Bust*  
Massachusetts Institute of  
Technology  
Cambridge, Massachusetts  
June 19-21, 2003



**2011**

*ROVs and the Offshore Oil &  
Gas Industry: Highlighting the  
Challenges that ROVs Faced During  
the Gulf of Mexico Oil Spill*  
Neutral Buoyancy Laboratory  
@ NASA Johnson Space Center  
Houston, Texas  
June 16-18, 2011



**2004**

*NOAA's National Marine  
Sanctuary Program:  
The Adventure of Mystery Reef*  
University of California Santa Barbara  
Santa Barbara, California  
June 25-27, 2004



**2012**

*Diving into History: The Role of ROVs  
in Exploring WWII Shipwrecks*  
YMCA Aquatic & Family Center  
Orlando, Florida  
June 21-23, 2012



**2005**

*From the Depths of the Oceans  
to the Far Reaches of Outer Space*  
Neutral Buoyancy Laboratory  
@ NASA Johnson Space Center  
Houston, Texas  
June 17-19, 2005



**2013**

*Ocean Observing Systems:  
Launching a New Era of  
Ocean Science & Discovery*  
Weyerhaeuser King County  
Aquatic Center  
Federal Way, Washington  
June 20-22, 2013



**2006**

*Ocean Observing Systems: Tools  
for Tomorrow's Science &  
Technology Workforce*  
Neutral Buoyancy Laboratory  
@ NASA Johnson Space Center  
Houston, Texas  
June 23-25, 2006



**2014**

*Exploring the Great Lakes:  
Shipwrecks, Sinkholes, and  
Conservation in the Thunder  
Bay National Marine Sanctuary*  
Alpena, Michigan  
June 26-28, 2014



**2007**

*Celebrating the International Polar  
Year: Science & Technology  
Under the Ice*  
Memorial University and the  
Institute for Ocean Technology  
St. John's, Newfoundland, Canada  
June 22-24, 2007



**2015**

*ROVs in Extreme Environments:  
Science and Industry in the Arctic*  
Memorial University and the Ocean,  
Coastal, and River Engineering facility  
St. John's, Newfoundland, Canada  
June 25-27, 2015



**2008**

*Diving to the Deep: Uncovering  
Mysteries of Mid-Ocean Ridges*  
Scripps Institution of Oceanography-  
University of California, San Diego  
San Diego, California  
June 26-28, 2008



**2016**

*From the Gulf of Mexico to  
Jupiter's Moon Europa:  
ROV Encounters in Inner  
and Outer Space*  
NASA's Neutral Buoyancy Lab  
Houston, Texas  
June 23-25, 2016



**2009**

*ROVs: The Next Generation  
of Submarine Rescue Vehicles*  
Massachusetts Maritime Academy  
Buzzards Bay, Massachusetts  
June 24-26, 2009



**2017**

*Port Cities of the Future:  
Commerce, Entertainment,  
Health, and Safety*  
Long Beach City College  
Long Beach, California  
June 23-25, 2017

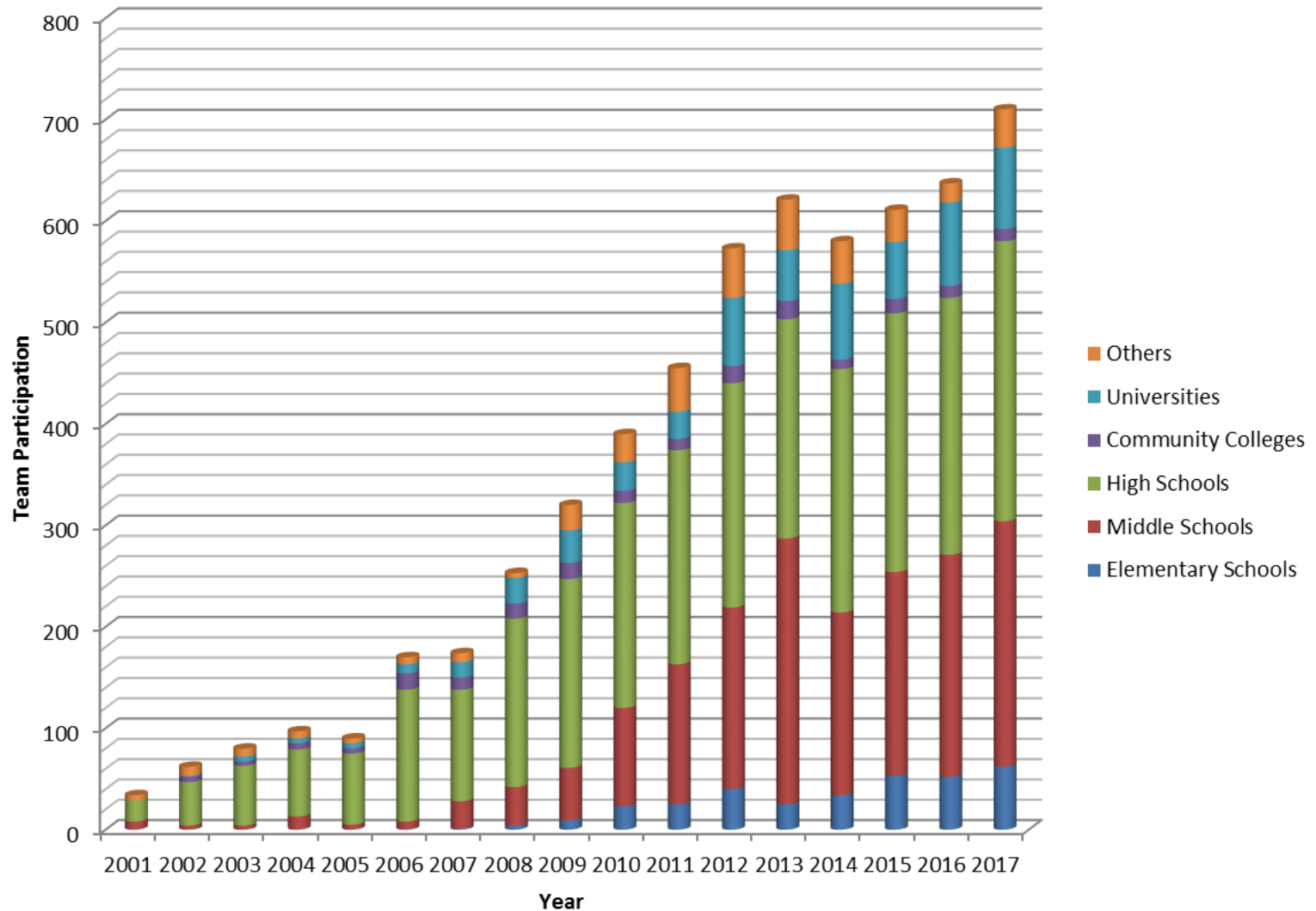


marine technology  
SOCIETY

Opportunity runs deep™

# COMPETITION REACH

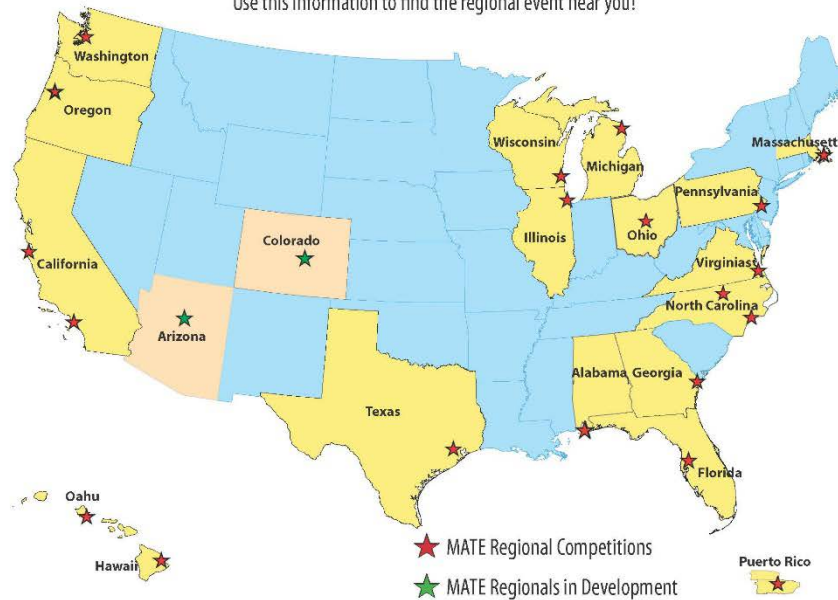
MATE ROV Competition Team Participation 2001-2017



# MATE Regional ROV Competition Network

The MATE Competition Network began in 2001 and currently consists of 31 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:

Bermuda, Canada (Newfoundland & Labrador and Nova Scotia), Egypt, Guam, Hong Kong, Indonesia, Scotland, Russia, Turkey





## SPONSORS



## SUPPORTERS



## PRIZE



## REGIONAL





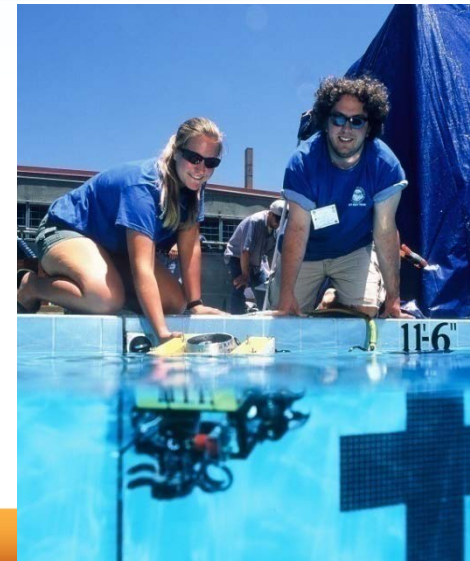
# COMPETITION STRUCTURE

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, 30 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

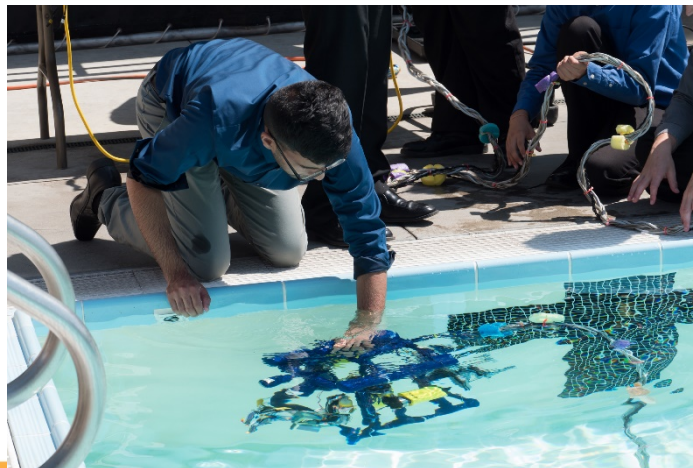
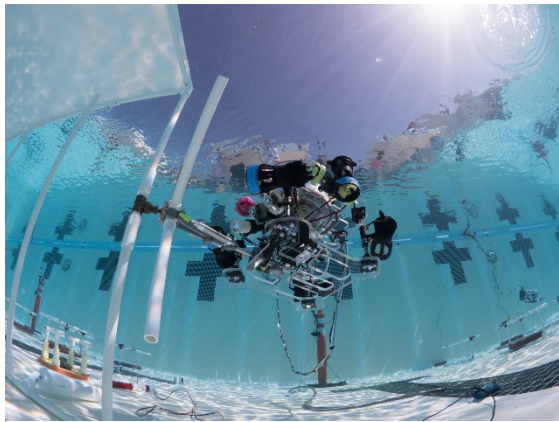
- **OVERALL**

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



# How many teams can you enter?

- The number of teams will vary depending on the regional event. More than one team per school/instructor may be permitted, provided that there are no common students (i.e., students can only participate on one team).
- If the regional cannot host more than one team per school/instructor, teams are encouraged to hold an in-school run-off to determine which team will represent their school/instructor at the competition.





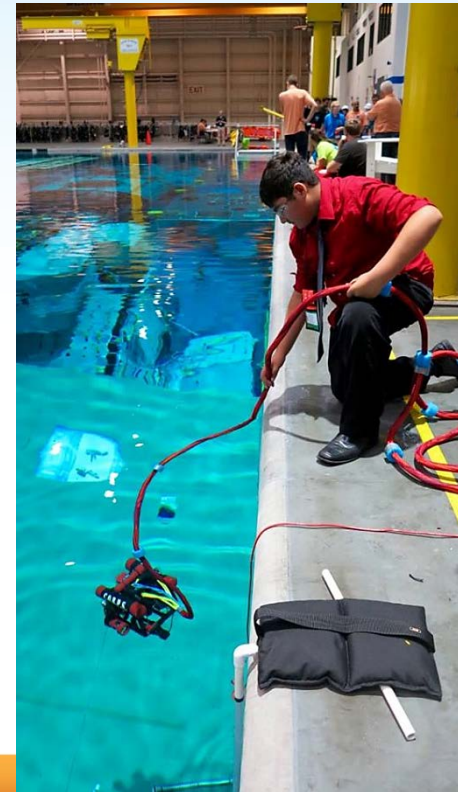
# SAFETY

## Pre-competition:

- Pneumatics/hydraulics quiz
- Safety inspection
  - Inspection sheet specific to each class posted online
  - Tutorial posted online walks through each line item on the sheet
  - RANGER & EXPLORER must submit info for review in advance of event

## At the event:

- Safety inspections
  - Dedicated safety officer(s)
  - Process used at the international – green safety cards





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

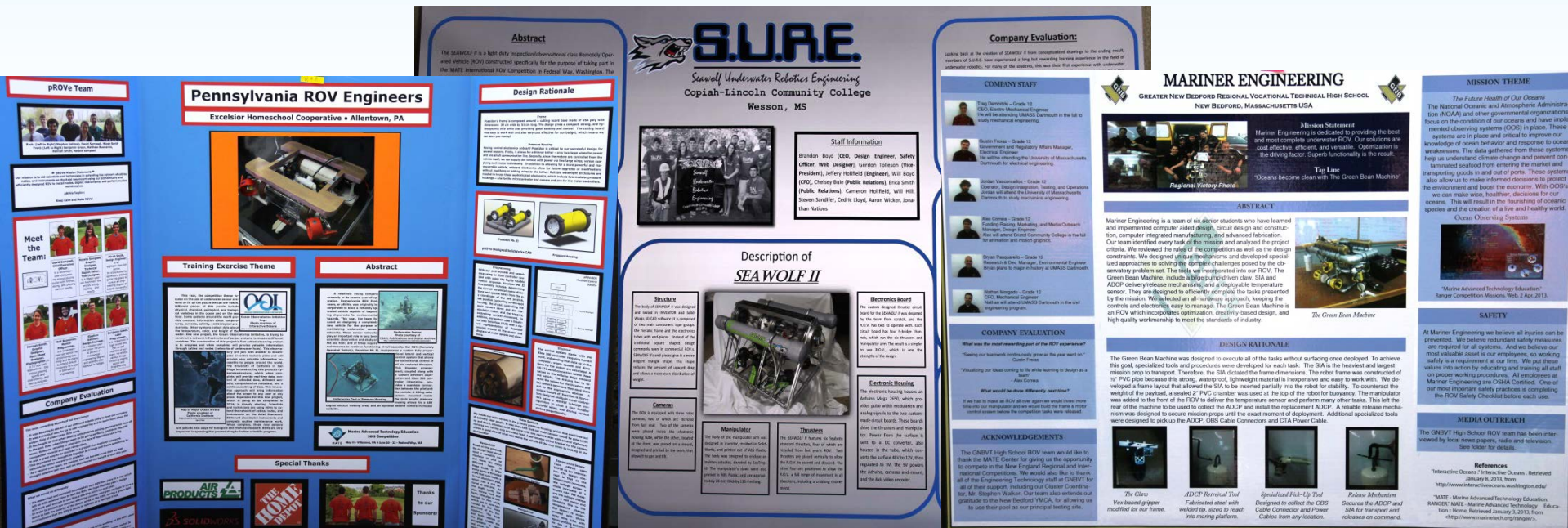
- Emphasize applying skills in new & innovative ways, working as part of a team, & understanding the breadth of business operations
- Challenge students to form companies and structure them with the personnel necessary to design, build, perform, & “sell” their product
  - Who is the company CEO and CFO?
  - 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 documentation and company spec sheets
- Oral presentations
- Marketing displays and “outreach and inspiration”





# 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 a company spec sheet AND SID for the safety inspection (RANGER's submit in advance)



# Company names, logos, tag lines, and marketing materials

- Global Ocean Exploration Systems

*Providing, surveying, sampling, and completion of underwater tasks around the world*

- Endeavor Enterprises

- Triton Technologies



## 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  
gabizeniithemag@sbcglobal.net





# Creative approaches to technical documentation

## 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.

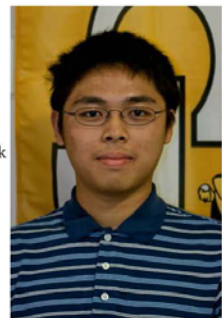
For three years GRT has brought the newest in underwater robotics technology to the market - introducing new systems like wireless control systems, intuitive joystick control, flight safety envelopes, onboard control interpretation, fail safe modes, and the best in structural foundations. As the new 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.

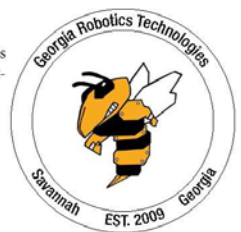
The leading wave - Georgia Robotics Technologies

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



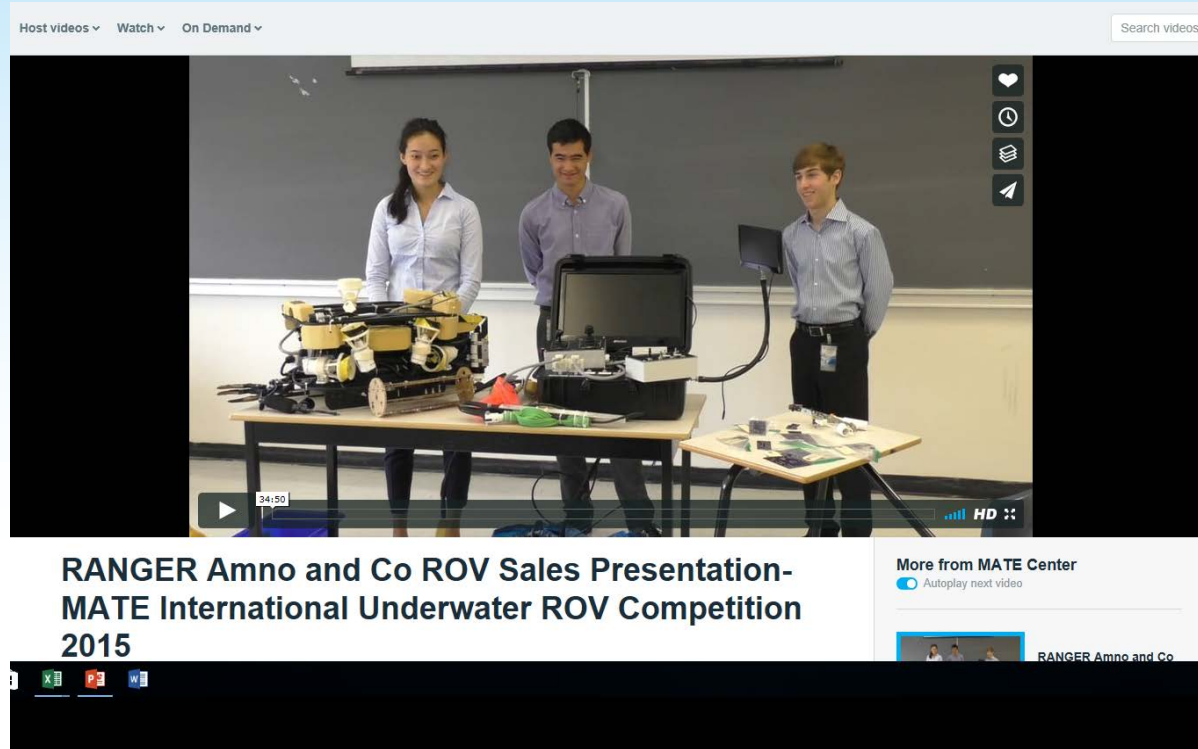
As the foremost underwater robotics venture in the southeastern United States, Georgia Robotics Technologies is located in Savannah, Georgia. With easy access to oceanic fronts, and other testing facilities, our products undergo constant testing and improvement in order to bring you the pinnacle of underwater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

**Photo on cover:**  
Image of ROV Beta during completed testing stages.



# Product presentations

**An opportunity to describe the engineering behind the ROV and sell the product (and personnel) to the client (aka judges)**



Check out MATE's Vimeo channel at  
<https://vimeo.com/user14545135>



# TIMELINE/COST/RESOURCES

- **Competition timeline**

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

- **Cost**

- ▶ 2017 registration fees
  - ▶ \$25 for SCOUT & \$50 for NAVIGATOR
  - ▶ \$150 for RANGER & \$250 for EXPLORER
- ▶ ROV and accessories
  - ▶ Depends on competition class and sophistication of the robot
  - ▶ Budgets are included within the team technical reports

- ▶ **Travel**

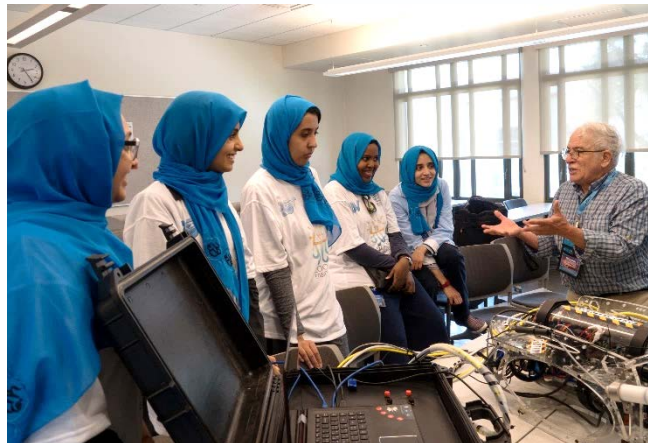
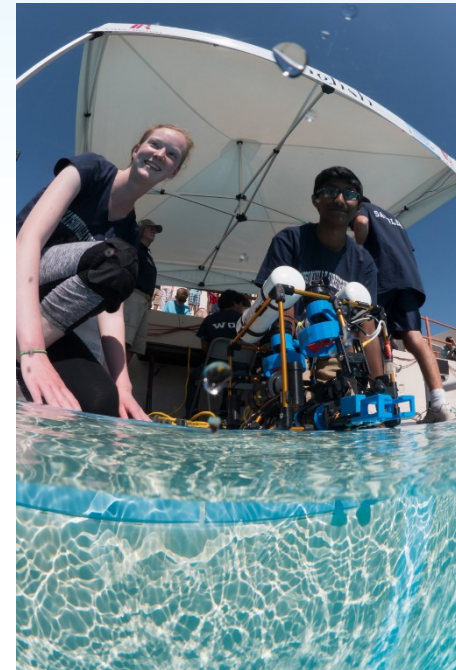
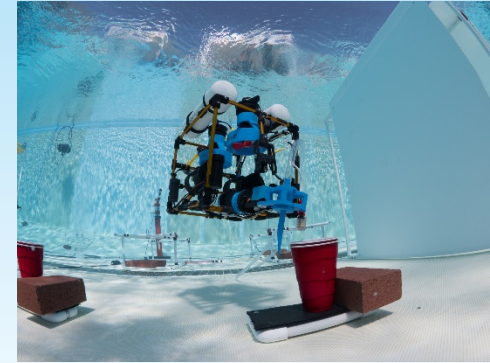




# TIMELINE/COST/RESOURCES (cont.)

- **Resources**

- ▶ MATE web site ([www.marinetech.org/rov-competition-2/](http://www.marinetech.org/rov-competition-2/))
  - ▶ Eligibility information, links to regional sites
  - ▶ Teams only area, FAQs board
  - ▶ Archive of technical reports
- ▶ SeaMATE store
  - ▶ Kits, accessories, powerpoles, and (soon!) crimpers
- ▶ Workshops
  - ▶ Regional
  - ▶ @ MATE
- ▶ Access to mentors





# RETURN ON INVESTMENTS

## Students have...

- Used the MATE competition as the focus of college entrance essays
- Gone on to pursue engineering or technical degrees
- Been awarded scholarships or internships as a result of their participation in the ROV competition
- Gone on to work at research facilities like WHOI and MBARI
- Been hired by Oceaneering, Schilling Robotics, General Motors, Virgin Voyages, NASA, Disney, and more!
- Started their own companies (OpenROV)



## 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)

