

MATE ROV Competition: Challenging students to develop technical and 21st century workplace skills

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President/Executive Director, MATE Inspiration for Innovation
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

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IT STARTED WITH A PILOT REGIONAL IN 2001 AND TO DATE...

- Has involved well over 18,000 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 32 (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



2018 marked the 17th international competition!



The History of the MATE ROV Competition



2002
Rime of the Ancient Buccaneer
NASA Kennedy Space Center and Brevard Community College
Cape Canaveral, Florida



2003
Last on the Titanic: Rusticles or Bust
Massachusetts Institute of Technology
Cambridge, Massachusetts



2004
NOAA's National Marine Sanctuary Program: The Adventure of Mystery Reef
University of California Santa Barbara
Santa Barbara, California



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



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



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



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



2009
ROVs: The Next Generation of Submarine Rescue Vehicles
Massachusetts Maritime Academy
Buzzards Bay, Massachusetts



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



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



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



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



2014
Exploring the Great Lakes: Shipwrecks, Sinkholes, and Conservation in the Thunder Bay National Marine Sanctuary
Alpena, Michigan



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



2016
From the Gulf of Mexico to Jupiter's Moon Europa: ROV Encounters in Inner and Outer Space
NASA's Neutral Buoyancy Lab @ NASA Johnson Space Center
Houston, Texas



2017
Port Cities of the Future: Commerce, Entertainment, Health, and Safety
Long Beach City College
Long Beach, California



2018
Jet City Aircraft: Earthquakes and Energy
Weyerhaeuser King County Aquatic Center
Federal Way, Washington



MATE

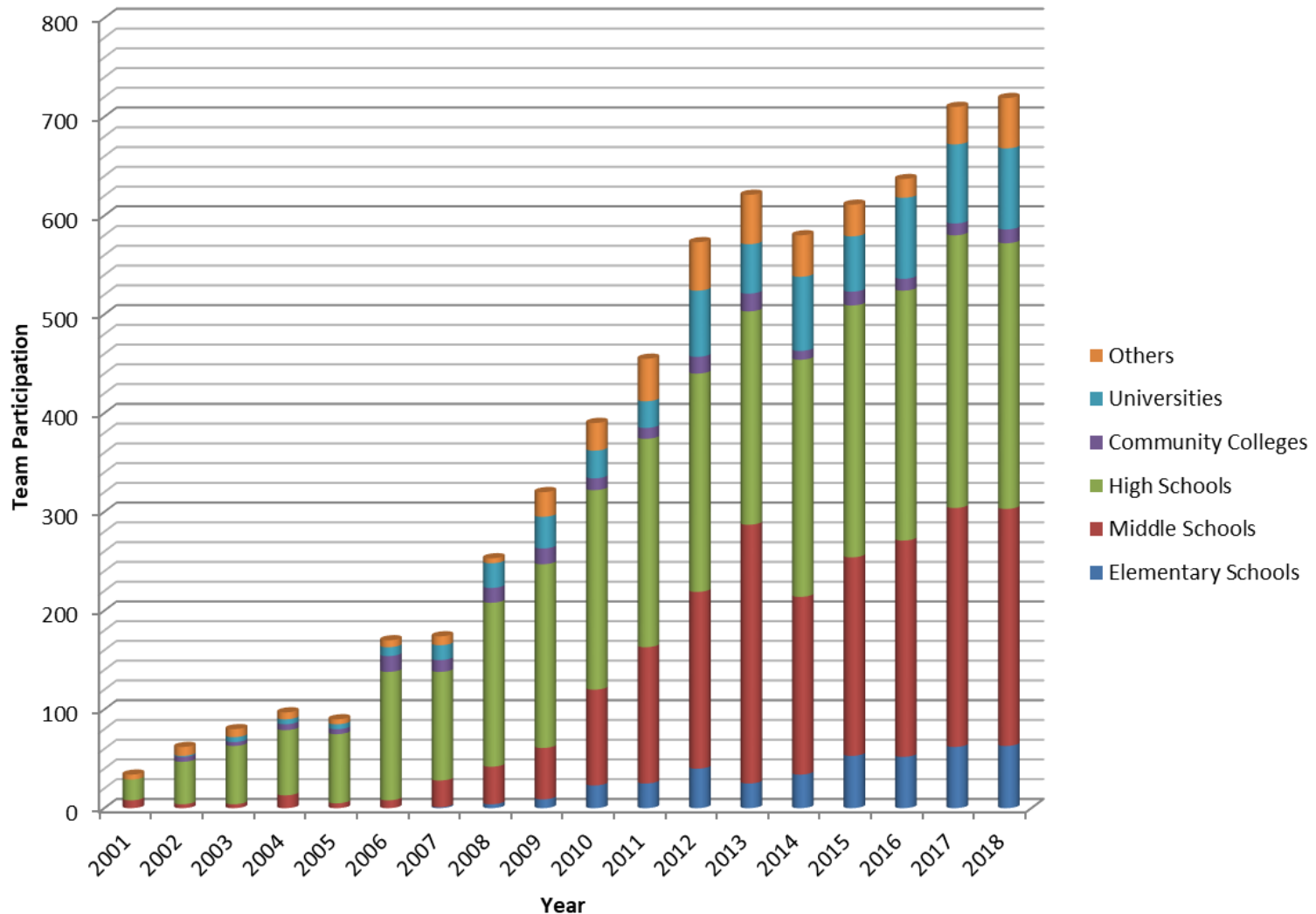


marine technology
SOCIETY

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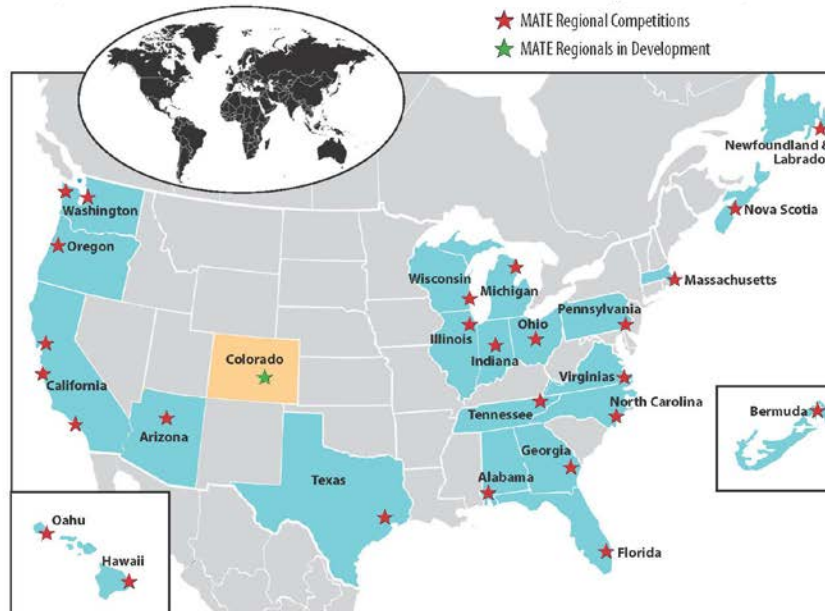
COMPETITION REACH

MATE ROV Competition Team Participation 2001-2018



MATE Regional ROV Competition Network

The MATE ROV competition Network began in 2001 and currently consists of 36 regional events that take place across the U.S. and around the world. Use this information to find the regional event near you!



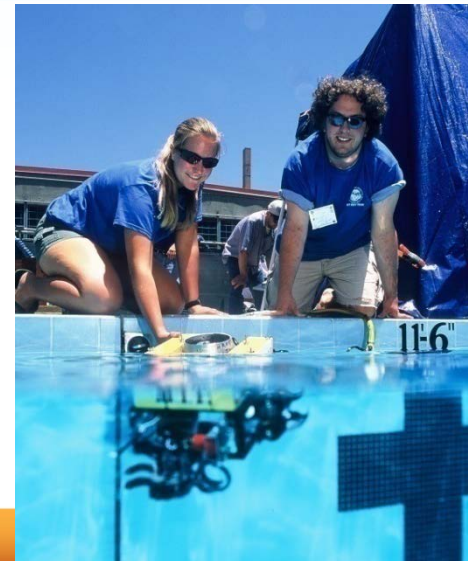
COMPETITION STRUCTURE

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**

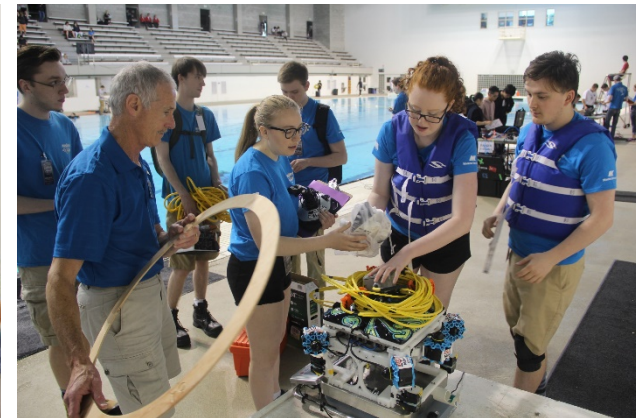
- 12 volts, 15 amps
- Camera required

- **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





2019 INTERNATIONAL CHAMPIONSHIP



Thank You to Our 2018 Sponsors and Supporters!

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SUPPORTERS

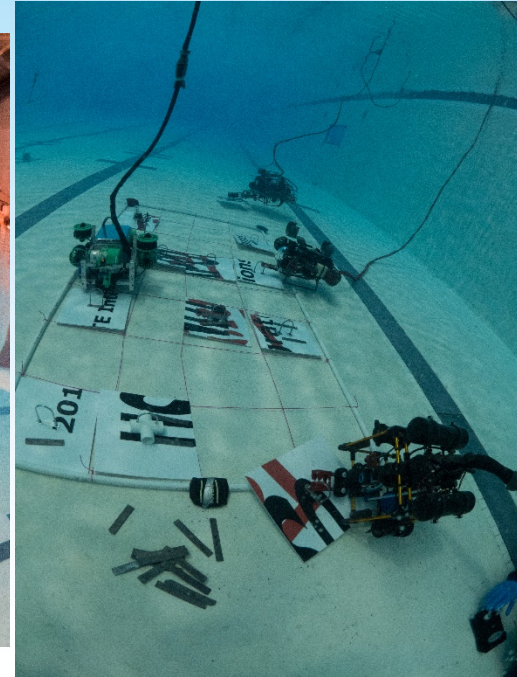
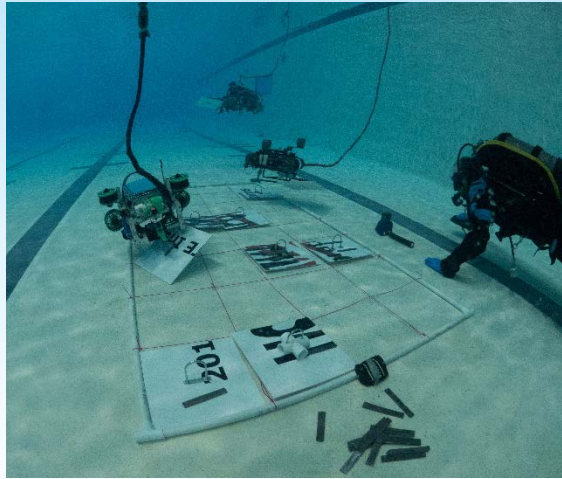


REGIONAL



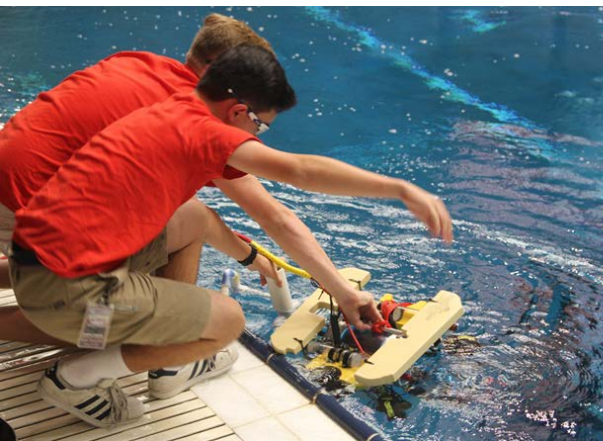
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BONUS MISSION *(shhh...it's a secret)*



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
 - Initial pre-competition safety inspection – 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”

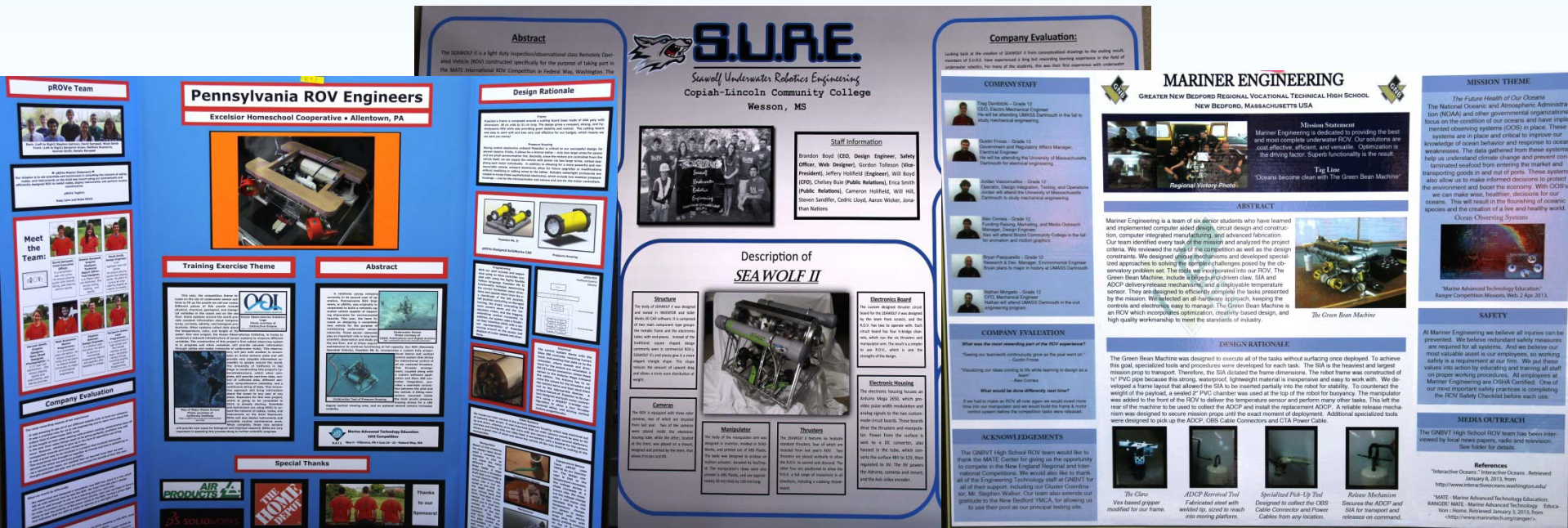
- Emphasize applying skills in new & innovative ways, working as part of a team, & understanding the breadth of business operations
- Challenge students to form companies and structure them with the personnel necessary to design, build, perform, & “sell” their product
 - Who is the company CEO and CFO?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



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



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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

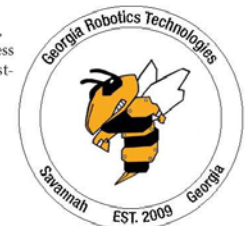
Michael Tam
Chief Executive Officer
Georgia Robotics Technologies
mtam77@gatech.edu



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.

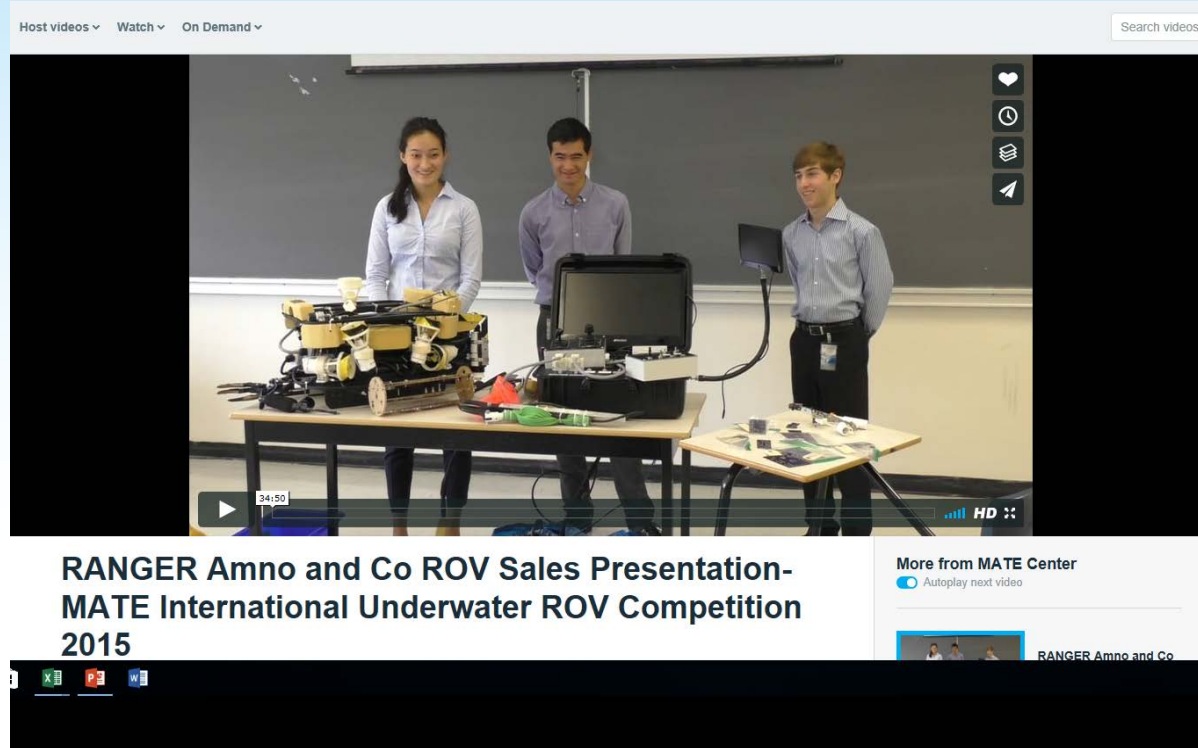
Photo on cover:

Image of ROV Beta during completed testing stages.



Engineering 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**

- ▶ 2019 registration fees
 - ▶ \$50 for SCOUT & \$100 for NAVIGATOR
 - ▶ \$200 for RANGER & \$300 for EXPLORER
- ▶ ROV and accessories
 - ▶ Depends on competition class and sophistication of the robot
 - ▶ Budgets are included within the team technical reports

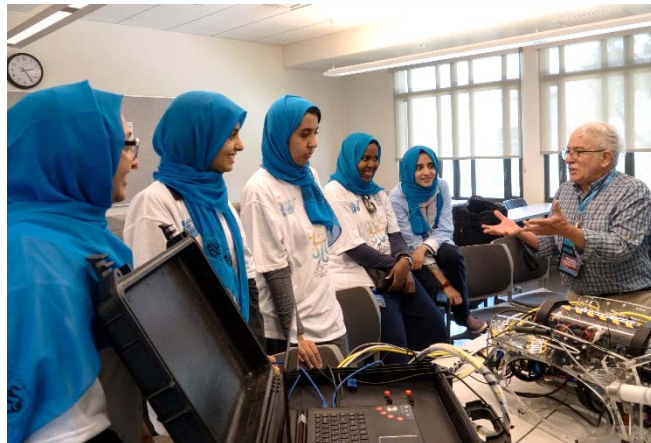
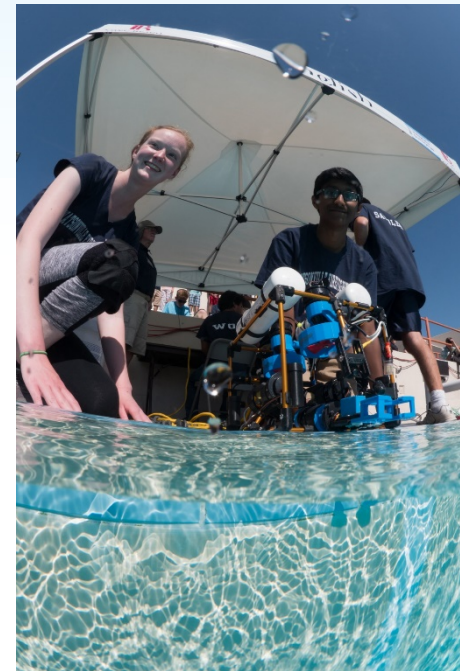
- ▶ **Travel**



TIMELINE/COST/RESOURCES (cont.)

- **Resources**

- ▶ MATE web site (www.marinetech.org/rov-competition-2/)
 - ▶ Eligibility information, links to regional sites
 - ▶ Teams only area, FAQs board
 - ▶ Archive of technical reports
- ▶ SeaMATE store (<https://seamate.org/>)
 - ▶ Kits, accessories, powerpoles, and 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)



2019 MATE International Competition

MATE heads to the mountains of Eastern Tennessee!

18th Annual MATE International ROV Competition

June 20 – 22, 2019

Kingsport Aquatic Center & Meadowview Marriott

Kingsport, TN, USA



STREAMWORKS
Powered by Eastman in Education



EASTMAN
FOUNDATION

Good for Good





Questions?

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