Special Feature

MATE 2012 International ROV Competition Poster Winners

The Marine Advanced Technology Education (MATE) Center's 2012 international student ROV competition was held in June in Orlando, Florida. Student teams from all over the world met at the YMCA Aquatic and Family Center to compete with remotely operated vehicles (ROVs) that they designed and built.

The 2012 theme was World War II shipwrecks. Student teams were required to engineer, fabricate, and pilot ROVs to assess the condition of a simulated World War II shipwreck and determine a course of action if the vessel still contained fuel oil, posing both an environmental and a socioeconomic disaster.

The competition encouraged students to think like entrepreneurs, requiring them to transform their teams into "companies" that responded to a fictional request for proposal (RFP) to deal with this very real-world situation. The RFP asked students to create an ROV and the specialized tools needed to document and remediate one of the more than 6,300 World War II shipwrecks resting on the bottom of the world's oceans.

Besides helping students learn critical science, technology, education, and math (STEM) skills, the ROV competition also helps them develop the teamwork, creative thinking, and problem solving skills that make them competitive in today's global workplace.

Fifty-five teams from the United States, Canada, Hong Kong, Macau, Taiwan, Scotland, Russia, and Egypt participated in the 2012 international competition. They represented middle schools, high schools, home schools, community colleges, universities, after-school clubs, and outreach programs.

The ROV competition is coordinated by the MATE Center and the Marine Technology Society (MTS) ROV Committee, with support from the National Science Foundation, the MTS ROV Committee, and other ocean and technology-related organizations. First held in 2002, the competition now includes 22 regional contests that feed into the international event.

The competition is judged by volunteers, who are working professionals in marine and technology industries. In addition to the underwater missions, teams must submit a technical report and deliver an engineering presentation to a panel of judges.

Poster displays are another key element of the ROV competition. Each team must submit a poster that provides general information about the ROV and explains in simple, non-technical language how the team planned, designed, and built its vehicle. A panel of judges evaluates and scores the posters based on how effectively this information is communicated.

Each year, the JOT recognizes the efforts of the two MATE poster winners by publishing the winning posters. MATE is grateful once again to the JOT for honouring the 2012 poster winners: Jesuit High School of Carmichael, California, in the EXPLORER (advanced) class and Cornerstone Academy of Gainesville, Florida, in the RANGER (intermediate) class.

Company Information

Manuel Angerhofer, CEO - Manuel has been an integral part of DeepView Technologies since 2008 and has served as the CEO for the last year. He has spearheaded DeepView Technologies initiative to increase research and development of our ROV's.

Jacob Darbyshire, CFO - Jacob recently joined DeepView Technologies in 2011, however his previous experience has been invaluable in developing new financial strategies. He has also been instrumental in developing payload tools.

Gregory Spencer, Chief Software Engineer - Since 2008, Gregory has been DeepView Technologies lead programmer and electrician. His latest breakthrough has been the integration of fiber-optic communication on the DVTP20-4. He is responsible for field testing our ROV and pilots it during missions.

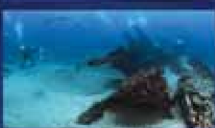
Emily Davis, Media Specialist - DeepView Technologies recently hired Emily in 2012 for her expertise in developing a positive corporate image. She has since developed multiple media connections and has garnered local coverage for DeepView Technologies.

Richard Hurlston, Chief Design Engineer - Richard has been improving the design and utility of DeepView Technologies ROVs for the last 3 years. His latest innovations in waterproof canisters and ROV frames has defined the development of the DVTP20-4.

Timon Angerhofer, Junior Software Engineer - One of DeepView Technologies newest employees, Timon was hired to assist in programming and software research in 2012. He developed a system that allowed us to monitor the voltage drawn by the ROV.

Timothy Davis, Video Specialist - As video specialist, Timothy has developed the use of and integration of new color cameras since 2011. He was able to increase our field of view and decrease the amount of cameras required by creating a camera tilt system.

Theme - WWII Shipwrecks



A Sunken Tanker

Deep below the ocean surface nearly 8,000 sunken WWII vessels lay like hidden ocean mines threatening worldwide ecological systems with their release of over 900 million liters of oil, large quantities of munitions, and over 300,000 tonnes of hazardous chemical. According to experts, the problem is too large to be ignored. Yet, although pollution from sunken WWII oil tankers clearly presents a significant threat to marine habitats around the world, most governments do not view the wrecks as an immediate environmental danger, or accept responsibility for the solution. Rather than adopting proactive risk-assessment and aggressive cleanup strategies, most nations take a wait-and-see attitude, reacting after the fact, only when necessary to solve the immediate environmental disaster. While nations have the technological means to address the problem, they lack the motivation to take responsibility. Since WWII vessels and their cargo have sovereign immunity, governments are not required to comply with international regulations that prevent pollution from ships. Furthermore, the issue of responsibility is a matter of complicated international debate. No matter where they lie on the ocean floor, sunken WWII vessels are under the jurisdiction of the government controlling the ship at the time of sinking. Any unauthorized clean-up efforts would be viewed as a violation of sovereign immunity, and would seriously strain diplomatic relations between countries, especially if the wreck is viewed as a war grave. While nations debate issues of jurisdiction and responsibility, time is running out. Responsible governments must act within the next three decades to preserve the marine environment from impending ecological disaster before the sunken vessels turn 100 years old and are redefined as submerged cultural resources under the UNESCO treaty. After that time, the wrecks become subject to restrictive rules and regulations that severely limit options for action. We at DeepView Technologies are committed to further developing lowcost technology to address this problem so that our children might live without fear of impending wide scale destruction of our oceans' ecosystem.

The image to the right shows the location of sunken WWII tankers. Each yellow line represents a tanker.

Deep View Technolo
Cornerstone Academy R

Gainesville, Florida, USA

On a mission to keep the oceans clean, from ecolo
disasters from the past, present, and future.

"Under Pressure, We Never Crack!"

Cornerstone Academy Team

Testing Circuits

MATE 2012 ROV
DVTP20-4 "Pearl"

Abstract

DeepView Technologies, based in Gainesville, Florida, produces advanced robotic systems designed to op
developed and manufactured a Remotely Operated Vehicle (ROV) perfectly suited to the task of salvagin
vehicle that is controlled from the surface using cameras and other electronic devices. Over 8000 ships, c
World War II. Typhoons and currents shift these wrecks, cracking hulls and releasing oil that has been trap
increases, putting many islands and habitats in danger of being damaged by oil slicks. Many already at ris
their recovery much more difficult. In recent years, ROVs have been used to survey wrecks and retrieve oi
known as the Pearl, has been created specifically to survey and prepare wrecks for salvage. After studying
efficiency of systems is key to accomplishing our task in a timely and effective manner. The Pearl can pro
be taken to clear the wrecks. All of our tools are designed to effectively clear the wreck of debris and retr
These tools are specially modified to accomplish all tasks, creating a comprehensive payload system capa

Company Evaluat

Most Rewarding Moment

Fiber Optic Cable and Connector

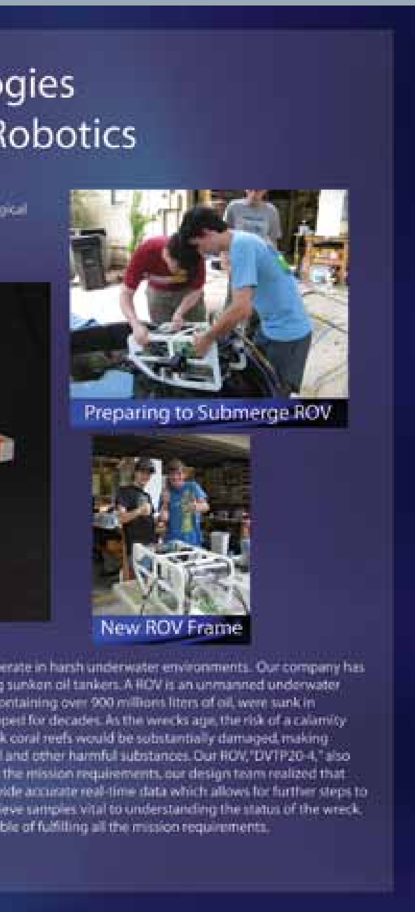
Returning from a successful competition last year, our team believed that changing the fiber-optics from the traditional VideoRay cables would significantly improve our ROV. As we experimented with the optical fibers, we hoped this new method would eliminate problems experienced the year before. The simplicity of the solution was shocking. The team buzzed with excitement when we realized this method was actually feasible, and would improve data transfer and decrease the size of our tether by over 32%. Our entire ROV has become much more maneuverable and visually appealing, as a result of our success with fiber optics.

Wha

Pan and

Acknowledgements

Cornerstone Academy – Fabco-Air, Inc. – Seabotix Inc
Dassault Systemes SolidWorks Corp. – Video Ray –
Jeff Marchand – David Shepard – Jeff Knack –



Design Rationale

As a part of our product maturation, DeepView Technologies has allocated large amounts of resources to design and fabricate more streamlined and minimalist systems. We consider our latest ROV, the DVTP20-4, also known as the "Pearl," to be the apex of our dedicated research and development. The Pearl and all of its components are designed and manufactured in our facilities. We sought to build a more aesthetically pleasing ROV while also increasing its utility. DeepView Technologies realized that the frames of our older ROVs were inefficiently designed due to their large size and low hydrodynamic shape. As part of our research, we tested a variety of plastics for strength, weight, and density. We chose UHMW (Ultra-High-Molecular-Weight polyethlene) as the main material for constructing our frame, due to its flexible yet resilient structure and its specific gravity, which is very close to that of water. Because of UHMW's remarkable qualities, DeepView Technologies was able to easily design a lighter frame that uses less material and provides a robust enclosure. Its strength also allowed us to to integrate a modular mounting system on the frame. DeepView Technologies decided that it was important to design a system which allowed for easy maintainence of our tools. We T-slotted groves along the frame which created a quick mounting system for our tools and canisters. Our experience with UHMW was so positive that DeepView Technologies decided to use the material in many of our other systems. In addition to the pneumatic cylinders, our redesigned gripper module is composed of mostly UHMW. Another innovation developed by DeepView Technologies was our incorporation of a pneumatic system to power our tools. Compared to our earlier electric systems, pneumatics is much more reliable and responsive, and performs better in underwater environments. In order to facilitate a complex pneumatic system on a small ROV, our engineers had to reduce the thickness of the Pearl's tether and develop a reliable and waterproof housing design. DeepView Technologies' underwater canisters were developed from scratch and went through numerous design iterations. Our final solution consists of two different canister designs. The first one consists of a clear acrylic tube that is bolted together for maximum sealability. These canisters are used to house our cameras and pneumatic valves because they allow a quick inspection. The other canister design uses a thicker acrylic tube that employs a quick-detach system, making it quicker and easier to access the inside while still being waterproof. DeepView Technologies specifically designed this canister to house our electronics which require the quick detach feature. The other innovation that allowed us to incorporate a pneumatic system was our use of a fiber-optic cable to relay data down to our ROV. Due to its small form factor, we were able to drastically reduce the size of the Pearl's tether, even though we had to add air-hose tubing for our pneumatics. Another benefit of the fiber-optic cable is its ability to instantaneously transfer data and eliminate electromagnetic interference. This opened up more possibilities for improving our onboard electronic systems, specifically the cameras. DeepView Technologies improved the Pearl's navigation by installing and waterproofing high definition color cameras. Our engineers were also able to minimize the number of cameras needed by integrating a tilting system into one of our canisters which gave us 90 degrees of viewing freedom. All of these changes have made the Pearl a more versatile, agile, and efficient system without sacrificing any functionality or compromising DeepView Technologies' legendary quality.

Milling UHMW Frame

Pneumatic Gripper

Custom Canisters

Pneumatic Piston

ROV Camera

Ranger

TEAM NAME
Cornerstone Academy
(Florida, United States)

MEMBERS
Manual Angerhofer
Timon Angerhofer
Jacob Darbyshire
Emily Davis
Timothy Davis
Sam Hurlston
Greg Spencer

MENTOR
Jeff Knack


TRITON
& Crew
rov tic
underwater solu
Mission: Engineering ROV systems that work well
Jesuit High School | Carmichael, California,
"Advancement of Knowledge Through Exploration
Design Rationale
Triton is a work class Remotely Operated Vehicle (ROV) designed to survey and remove fuel oil from
shipwrecks in the Marine Advanced Technology Education (MATE) Center International ROV Competition.
sioned and created by ROVotics Underwater Solutions, an ROV company that produces specialized vehicles for
ents all over the world, Triton ultimately made its way from the drafting board to the pool deck through a
tured build process that included several design reviews, prototypes, and revisions.
Triton utilizes an open frame design, common to many work class ROVs, providing flexibility for mounting
sories, access for field service, and minimal water resistance when maneuvering. Four of Triton's six thrusters
positioned at the frame's corners to allow for precise, vector-based control, and the two vertical thrusters are
sitioned inside the frame for protection. Triton comes equipped with the latest in precision depth,
and heading sensors. Triton's undercarriage is primarily polycarbonate and nylon hardware reducing
around the metal detector. The fuel oil retrieval systems (FORS) is a closed loop configuration preventing any
ondary environmental contamination. Triton is also equipped with the necessary tooling to do heavy lifting
and delicate coral removal and transplantation. Triton has custom built accessories designed specifically to
plete this year's MATE mission.
ROVotics Company Picture & Triton ROV
Abstract
ROVotics is an underwater engineering company specializing in the design and application of Remotely Operated Vehicles (ROVs) tailored to accomplish our clients' goals quickly, easily, and affordably. Our experienced and capable team of engineers, in conjunction with a well trained, skilled operations crew, allow us to conquer the most difficult of underwater challenges. We have been in the ROV business now for seven years and have successfully completed a great number of missions, notably the capping of the Deepwater Horizon oil spill last year.
This year we were presented with a new mission: the survey of WWII wrecks and the removal of hazardous fuel from such sites. Over 6,000 of such wrecks are believed to lie intact on the seabed all around the world. Decades of deterioration leave many on the verge of leaking massive amounts of oil into the ocean, the environmental and economic repercussions of which would be devastating. To prevent such a disaster, ROVotics has released its latest ROV, Triton. With original designs worked out through organized brainstorming and small group discussion, Triton's many specialized tools underwent a process of research, design, component and full integration testing. The team has operated with Triton in over 40 hours of mock missions with the use of a replica of the SS Gardner. During mock missions, each tool was scored as to its effectiveness in its ability to perform each task. This qualitative and quantitative analysis guided the fabrication of each tool towards the final design. The stringent testing and robust engineering process that went into creating Triton makes it the best option for dealing with this problem.
Staff
Joe Griffin (MIT) '12
Chief Executive Officer
Evan Arnold (Stanford) '12
Chief Financial Officer, Pilot
Alan Luu (UC Berkeley) '12
Website Administrator
Greg Marchese (UC San Diego) '12
Director of Engineering
Spencer Breining-Aday '13
Head Machinist, Pilot
Chris Konstad '13
Head Programmer
Drake Nylund '13
CADD/Safety officer
Jesse Tambornini '13
Head of CADD, CNC Specialist
Amirali Akhavi '14
Engineer
Tyler Honnold '14
Engineer
Nolan Schneider '14
Engineer/Quality Assurance
Nick Sopwith '14
Programmer/Electronics
Andrew Standriff '14
Engineer
Alex Aprea '15
Programmer/Composites
Jared Borg '15
CNC Operator
Ryan Kenneally '15
Engineer/Composites
Matthew Woolgar '15
Engineer/Composites
Catalina Co-Pilot (GUI)
Designed with the customer in mind, Triton's control system, which is based
ROVotics' proprietary C++ software in both the topside control system and
bedded microcontrollers, allows smooth and precise control and monitoring
vehicle health via an intuitive Graphic User Interface (GUI). The ROV safely
down in the event of a communication failure. Triton's pilot interface allows
reversal of control allowing piloting with the front or rear cameras. A
digital compass and depth sensor give Triton the ability to automatically
heading and depth to allow for easy and accurate surveying of
wrecks. Serviceability is facilitated via accessible modular electronics pods and
quick release buoyancy compensator.
Neutron Backscatter and Ultrasonic Sensor
Rear Electronics Enclosure
- Neutron and ultrasonic device mounted on rear of ROV
- Pilot and co-pilot have capability to reverse controls and pilot the ROV in reverse
- Devices are shock mounted to provide gentle contact with ship's hull and calibration tanks
- Wide 130 degree rear view camera with 640 lines of resolution
- High power electronics and speed controllers isolated from telemetry and microprocessors reducing interference
Buoyancy
- Foam pod coated
glass shell to prevent
- Calculated to bring
buoyancy
- Optimized shape for
components
Electronic Compass
- Real-time digital compass transmits heading information to co-pilot interface
- Digital compass raises above ROV frame to prevent electromagnetic interference
- Real time reading used for ROV heading hold
Linear Measurement System
- Rear hook connects to ship stern
- Acrylic tube allows for easy reading
- Tension reel keeps system taut
Triton
Capabilities
ROVotics is capable of producing ROV's that are precisely machined and manufactured due to its extensive machine shop and experienced staff. We operate a CNC (Computer Numerical Control) mill that can manufacture parts accurate to one thousandth of an inch, a combination lathe/mill, drill presses and other common shop equipment.
CNC Mill
Our experienced team members are trained to operate these machines safely and efficiently. ROVotics also has the capability to design and outsource custom PCB's (Printed Circuit Boards) to keep the electronics in the ROV modular and space efficient. Additionally, we have on-site test facilities, so new accessories can be manufactured and tested with little delay.
Custom Printed Circuit Board
Coral Payload
- Front slicing edge cuts coral from hull
- Pneumatic dumping allows for precise placement of coral
Pressure Sensor
- 20-250kPa (3-36PSI) absolute reading
- Depth measurement to 14m (45.9ft.)
- Real time reading used for ROV depth hold
Metal Detecting Whiskers
- Mounted away from the metal frame
- Powerful magnets are attracted to metal debris but not to nonmetal debris
www.marinetech.org
www.rovotics.us

Explorer

TEAM NAME
Jesuit High School
(California, United States)

MEMBERS
Amirali Akhavi
Alex Aprea
Evan Arnold
Jared Borg
Spencer Breining-Aday
Joe Griffin
Tyler Honnold
Ryan Kenneally
Chris Konstad
Alan Luu
Greg Marchese
Drake Nylund
Nolan Schneider
Nick Sopwith
Andrew Standriff
Jesse Tambornini
Matthew Woollgar

MENTORS
Rolf Konstad
Jay Isaacs
Peter Brown
Julia Yang