

University of Waterloo Underwater Technology Team

ADVANCING UNDERWATER TECHNOLOGY AND DESIGNING
SUBMERSIBLE REMOTELY OPERATED VEHICLES FOR THE FUTURE

San Diego 2008

Thursday June 26th

On June 26-28, 2008, team members traveled to San Diego California in order to compete in the 2008 MATE underwater robotics competition. This year the team completed the manufacturing of a new manipulator, along with software, and maintenance upgrades.

Tasks

The 2008 competition aimed to simulate deep sea exploration. Sub-sea heat vents were constructed using ABS pipe. Water was emitted through each heat vent via a hose which expelled water with a temperature different than that of the surrounding area. An official temperature sensor was placed in each vent allowing the judges to compare the readings of each team. Each team needed to reach a heat vent and measure the temperature of the water being expelled from it.



The rescue of an OBS or Ocean Bottom Seismometer needed to be performed. The OBS was secured to the “sea bottom” by covering it with 2lb dive weights or “lava”. The ROV needed to remove lava from the OBS in order to increase its buoyancy thus allowing the OBS to float to the surface.

Each team was required to collect or demonstrate possession of a piece of lava, or return it to the surface for retrieval. The latter of the two proved to result in a greater score.

Presentation

In addition to completing tasks, the presentation and communication of the design also weighted heavily in the team’s scoring. Areas such as a judged presentation and question/answer session, technical report, and poster board presentation showed to be the strength of our team.

Judges were impressed with our innovative concepts. They especially liked the idea of the head mounted display. The design of our frame was also favored for its rigidity. Our exhibit described the design, build and testing process. It included information regarding possible applications of our vehicle.

Results

Disappointingly, our team suffered from electrical connection problems. While setting up for the first attempt, we could not establish communication with our ROV. Through rapid troubleshooting, the problem was eventually

found: one of the power connections had lost continuity. On a more positive note, our team was strong in the communication aspect of the competition. We were able to exhibit our innovative concepts to the judges and performed well in both the oral and poster board presentations.

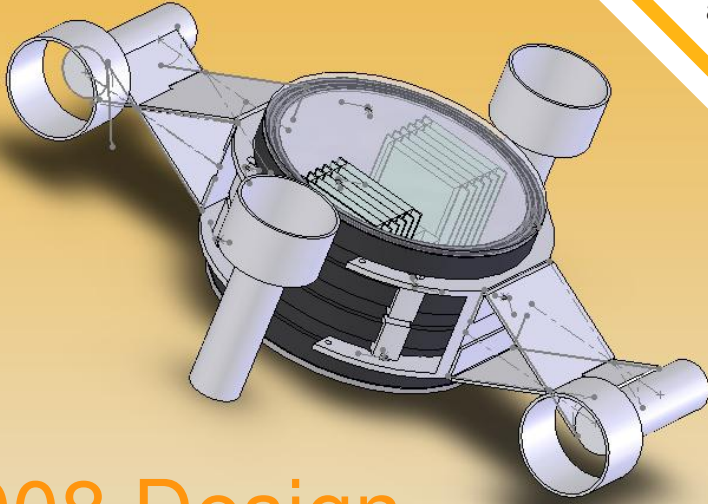
Over all, we placed 17th out of 23 teams. The team's documentation brought us to 10th place for our technical poster, and 9th for our oral presentation.

Scripps Tour



FLIP Nearing the end of the multi-day competition, team members attended a tour at the Scripps Institution of Oceanography. Our first tour at Scripps was of the FLIP. The FLIP is a specially designed, one of a kind sea going vessel that has the ability to flip from its normally horizontal position, to a vertically standing position. Most ships at sea have the problem of moving with the sea. When in its vertical position, the flip is very stable. It is the perfect platform for experiments requiring “solid ground” at sea. Since the ship moves from the horizontal position to the vertical position, it needs sinks, toilets, kitchen equipment, beds, etc, that are able to handle the transition. Thus the kitchen and engine exhausts swivel, so that

when the ship flips, everything remains in the proper orientation. Lab equipment must be strapped to the wall in order to be on the floor once the vessel is flipped. [AUV Lab](#) The second tour was of the AUV lab. Explanations of autonomous surveillance vehicles were presented. One AUV used a single thruster with the ability to pan and tilt. Reducing the number of thrusters saves energy for long surveillance missions. Another AUV was a thruster-less winged vehicle that used variable buoyancy to move it through the water. The ability to view cutting-edge AUV technology has contributed to the design of our upcoming vehicle.



2008 Design

ROV / AUV Design

The new design focuses on a compromise between the working and observation class ROV. It has a slight bias towards the observation class and has the expandability to carry many accessories. The upcoming vehicle is being designed with the intent of being both autonomous and tethered, making it both an ROV and AUV. Satisfying the requirements of both tethered and autonomous aspects means many innovations must be used to meet the

demands that come from combining individual parts into a flexible multi-purpose system.

Thruster Configuration

The thruster configuration requires that little energy is consumed during vehicle operation. Having thrusters statically mounted in varying angles to one another in order to accomplish what is known as vectored thrust allows the vehicle to move in combinations of directions, rather than the classical forward/reverse, left/right. However, using

thrusters mounted at fixed angles results in canceled out forces.

Electronics

The new electronics design utilizes an ultra-small pico-ITX embedded computer to perform stability calculations, and potentially vision processing. The previous design used a laptop which was located at the operator interface. Placing the computer on-board the vehicle solves bandwidth problems that were encountered since all stability data needed to be

sent up the umbilical to the operator PC. In addition, the on-board PC allows the Remotely Operated Vehicle (ROV) to seamlessly transform into an Autonomous Underwater Vehicle (AUV). Traditional ROV technology relies on serial communication between system devices. Our next generation ROV/AUV will implement a higher bandwidth SMBus, which allows for future expandability, and greater plug-and-play potential.

Recruiting Event Thursday, September 18th

To the student, September is the month of new beginnings. A new school year begins. Successes and failures become mere reflections. Similarly, for UW2TT, it marks the beginning of a new ROV design, and new team members. Throughout August and September, the software, mechanical, and electrical teams have been laying down the foundations and goals of the 2009/2010 design. In order to complete the design and bring the vehicle into reality, more personnel are required. On September 18th a joint recruitment meeting between the university of Waterloo robotics team, and the university of Waterloo underwater technology team was held. A room full of eager students in various disciplines gathered to see how they could contribute to the many hands-on teams. Teams such as the minesweeper robot, a GPS driven autonomous land robot, the mini robotic sumo competition, and many others. From those who attended, we were able to gather knowledge in the form of persons joining the software, mechanical, and electrical groups within UW2TT.

Engineering Alumni Event Saturday Sept 27th

On Saturday September 27th 2008, UW2TT participated in the Engineering Alumni Event. Many engineering graduates from the 2007, 2003, 1998, 1993, 1988, 1983, 1978, 1973, 1968 and 1963 classes were able to attend and take a look at the many university teams that have ongoing projects. From the solar car, to the MEMS team, everyone was able to ask questions about current projects, and undergraduate innovation. The many UW engineering teams give students the ability to apply the knowledge they learn in their degree programs. Applying knowledge often leads to a greater understanding of their respective fields. We had the pleasure of talking with sponsors of the team who also happen to be UW graduates. One of such sponsors was Indal Tech (Curtis-Wright controls) which specializes in marine defense. Thanks to the Solar Car, Magellan, Minesweeper, MEMS, and UW2TT teams for making the event a success. UW Grads were able to meet up with old friends, collect university memorabilia and spend time back at their engineering home (POETS). The expected showers did not dampen the spirits of the various teams. Thankfully the clouds did not think to fulfill the POETS acronym, and did not release showers on everything.

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