

### **An Experience We'll Always Remember In A Place We'll Never Forget!**

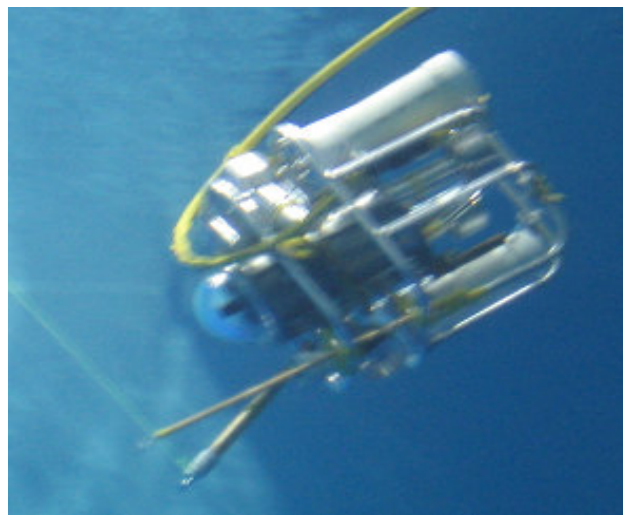
The Ups and Downs of the 2007 MATE ROV Competition

After months of preparation we made it to the 2007 MATE ROV competition. In the final phases of testing and assembly numerous problems were encountered and overcome by the team. From leaking housings and seizing motors to faulty communications between the GUI and our custom control boards we faced it all in the final weeks leading up to St. John's. This newsletter contains a series of stories discussing the various obstacles that were overcome while we debugged and ultimately successfully operated our vehicle at the competition. We also discuss the amazing experience that we had in St. John's after competition events ended.

#### **Naming of The System**

Delayed Naming of the Vehicle

It was late on the eve of the competition (3:30 am Saturday morning) as we were debugging one of the last remaining problems with the vehicle. The GUI was not correctly solving the matrix (6 equations used to determine the power level for each thruster given the desired force and moment on the vehicle). This matrix is solved and relayed to the vehicle 20 times per second and without it, we are not capable of controlling the vehicle. It is this matrix and the way that we can use it to provide full six degrees of control that is truly unique to our system. As the night progressed and we became more desperate the idea that we needed Neo (from the movie trilogy The Matrix) to solve our matrix was suggested. Immediately we knew that we had found the ideal name for our system. That night the problem was not fixed but early the next day (in time for our first task) the matrix for "**NEO 1**" was successfully solved and over the duration of the competition it was successfully solved and transmitted to the motor control board over 56 000 times.



## The Joys of System Integration

### Issues Discovered and Overcome During Final System Testing

Although the entire vehicle had been completed weeks in advance of the competition complete system integration had not taken place. Each component had independently been tested but problems arose as these systems were interfaced.

The first problems that were discovered were mechanical and they were biggies!! Our main electronics housing leaked and our thrusters began to seize with prolonged operation. We quickly found a local company able to provide us with bearings that met our needs and solved the problem of our seizing thrusters. However fixing our leaking housing was not as straight forward. We were able to tell that the leak was coming from the welded seam of our rolled and welded housing but could not pinpoint the exact location. So, at 2:00am the morning before convocation for some of the team members we were layering on the marine epoxy over the seam. This method worked but needless to say we won't be using the same housing again next year.



Numerous other problems appeared throughout the final week:

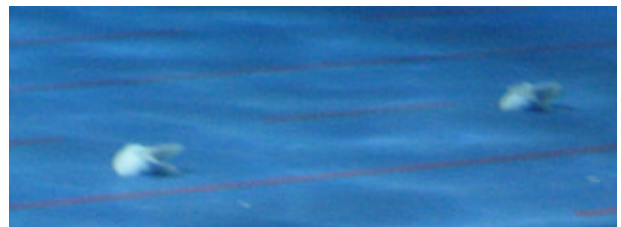
- The o-rings that we were supplied for the back plate were not the correct size.
- One of the potted connectors began to separate from the brass fitting.
- Communications between the control computer and boards would periodically fail.
- Our control software was not correctly solving the required equations.

Through many long days and long nights, the team rallied and solved all of these problems in time for our first mission at the competition...Where yet further problems were encountered.



Just prior to our first mission part of our pan and tilt camera system failed and could not be repaired. After borrowing a camera from the advisor of a Vancouver based secondary school our hopes were high. Unfortunately no image was displayed when the vehicle entered the water and we were unable to attempt any aspect of the mission while the problem was debugged. The issue turned out to be a loose connector but we were out of time when it was discovered.

Going into our second mission (the ice tank), again our hopes were high. We submerged the vehicle into the water and the image was good. The pilot took control of the vehicle and off we went. However, not more than 5 seconds into our mission, a design flaw that had previously gone unrecognized appeared. One of the rear propellers came loose and separated from the thruster. A couple minutes later a second propeller flew off. Despite this obvious handicap, the vehicle remained controllable and successfully completed part of the mission. Unfortunately with the missing propellers there was not enough thrust to return the simulated specimen to the surface.



On our third mission we again encountered problems with our propellers and did not have the required power to overcome the flow. Of the 19 team competing we placed 4<sup>th</sup> in our engineering evaluation but only 10<sup>th</sup> overall.



Despite our challenges we truly enjoyed the experience and have a lot of ideas for next year.



**A Well Deserved Vacation**  
Exploring St John's

After the competition all members of the team spent at least some time exploring St. John's and seeing what it has to offer. From climbing up Signal Hill, to exploring the sights around the Irish Loop this is a truly special place.

Standing atop a rugged cliff, watching the whales and gannets feast with icebergs in the distance is something that will never be forgotten. In just a few short days we had the opportunity to see icebergs and whales, seals and gannets and even a moose and some puffins.



## Canada Day

### UW Robotics Team Shows Off at Waterloo Canada Day Celebrations

July 1<sup>st</sup> marked the 140<sup>th</sup> anniversary of confederation for Canada and the 23<sup>rd</sup> annual Waterloo Canada Day celebrations hosted by the University of Waterloo Federation of Students. The event included music, food, fireworks and robots. Both young and old were interested in the variety of vehicles that the team has developed over the years. It was a great opportunity for the team to interact with the community and showcase how robotics are currently being used and how they will continue to change the way we live our lives.

