MATE ROV COMPETITION Scotland

Braeview Academy's Young Engineer's

AQUA ECHO

Technical Report

SUBSEA UK

ROVOP
KNOWLEDGE IN DEPTH

RGU

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Introduction

Team Members

Hannah Ferry – 14 – S3

CEO

2nd year competing at regional competition

Career goal – Forensic Computer Analyst

Ellie Macpherson – 14 – S3

CEO

1st year competing at regional competition

Career goal – Offshore engineer

Loni Stephenson – 15 – S3

Safety officer

1st year competing at regional competition

Career goal- unsure

Jessica Winter – 14 – S3

Marketing officer

1st year competing at regional competition

Career goal – unsure

Maci Hansen – 14- S3

Marketing officer

1st year competing at regional competition

Career goal- Midwife

Ty Neofitos – 15 – S3

Tether

2nd year competing at regional competition

Career goal – Musician

George Mcarthur –14 – S3

Pilot

2nd year competing at regional competition

Career goal–Surgeon

Callum Wallace–15 – S3

Head of graphics

1st year competing at regional competition

Career goal-Graphic designer

Tristan Allan –14 – S3

Electrical engineer

1st year competing at regional competition

Career goal –GP

Kyle Ferguson – – S3

CFO

1st year competing at regional competition

Career goal –

Abstract

We are a team from Braeview Academy in Dundee which consists of 10 students all in S3. This is the team's second year entering the competition although we now have 7 new members. Aqua Echo is designed to be able to take on the tasks provided in this year's competition: - Innovations for inshore: ROV Operations in Rivers, Lakes, and Dams. We started to design our ROV in August 2018 by planning on paper and discussing what things we would like to change about this year's model. In early September 2018 our school went on fire and we were sent to a different school in the city for 3 months while Braeview got portacabins set up for us to return too, so during this time no progress was made. We started back up in January and have worked very hard to get a fully working ROV competition ready.

Schedule

	A	B	C	D	E	F	G	H	I	J	K
1		Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19		Apr-19
2	ROV	Paper diagram and plan					Finalised design	Made Protype out of MDF	Started to assemble	Finished ROV	
3	Technical report								Started	Completed	
4	Poster									Started	Completed
5	SPEC Sheet								Started	Completed	
6	SID								Started	Completed	
7											
8											
9											
10				Key							
11					Time when no progress was made due to the school fire						
12					Not Started						
13					In progress						
14					Finished						

Design rationale

We decided to build a newly improved ROV instead of returning with last year's design. We changed the shape slightly and added a few things to make it more aerodynamic. We also took on board the suggestions we received at last year's regional competition and have tried to incorporate these into our design. We sketched our ROV out on paper before making an MDF model so we could fully check the measurements were correct.

Frame and Structure

We decided to make our ROV frame out of acrylic. The frame is based on a shark with a white acrylic fin on the top to support the umbilical which we have attached floatation too so it isn't as heavy in the water, our ROV also has a "fin" at either side to accommodate our side thrusters. We have put foam into our ROV and a plastic container that we can fill with metal weights to achieve as near to neutral buoyancy as possible. We have picked black and white as the colours of our ROV because it contrasts well with the water and makes it a lot easier to see, and therefore making it safer.

Thrusters

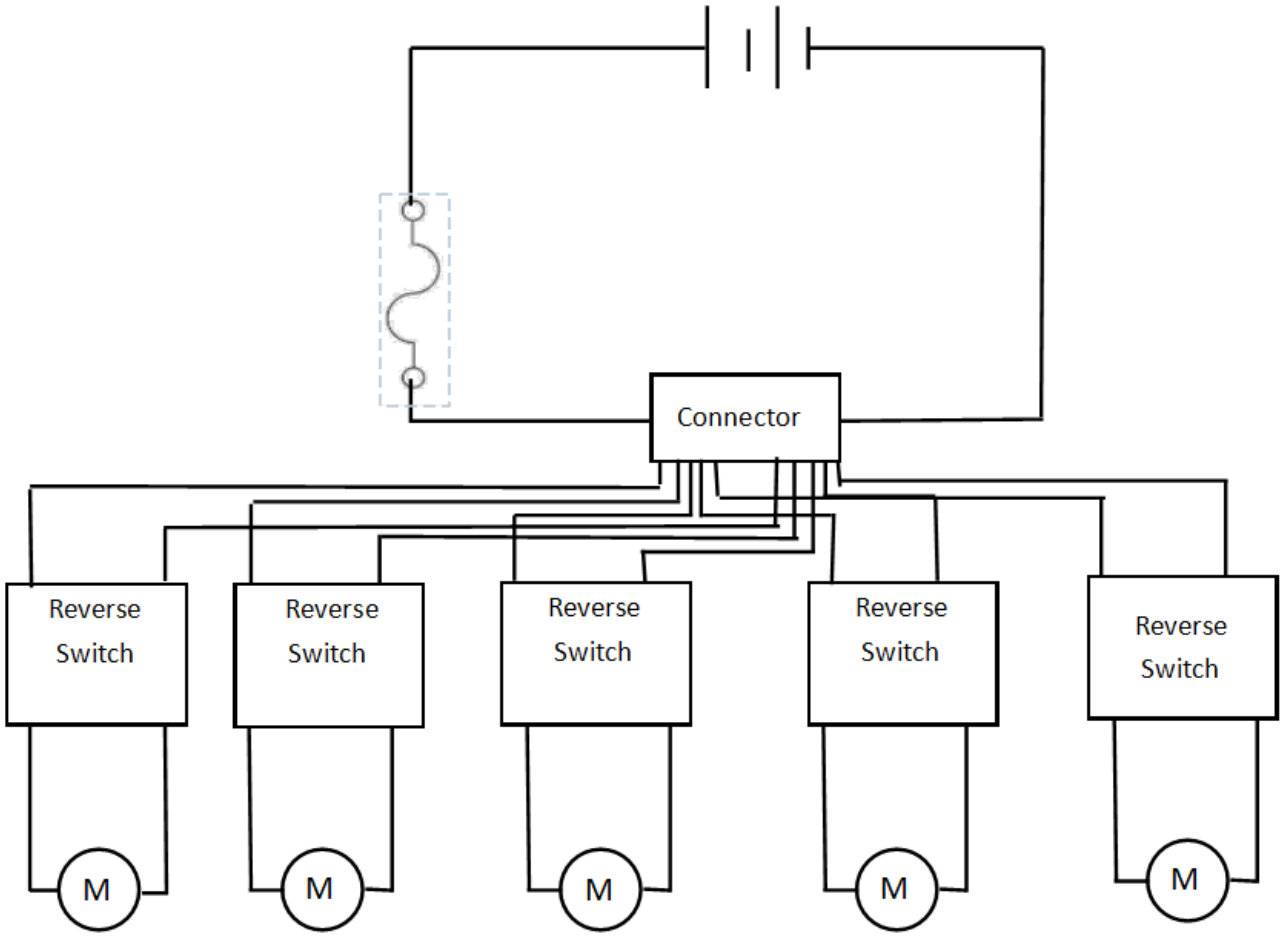
Our ROV is equipped with five 12 volt thrusters (one more than last year). We have positioned them at the side of the frame for turning and two up and down thrusters for vertical movement placed as near the centre as we could so it helped even out our buoyancy and keep it level. Our last thruster is inside the frame but at the back to increase horizontal movement and the overall speed. Our propellers were downloaded from (website name) and then 3D printed. We have attached cowls to our ROV to ensure that they meet the safety regulations required and allow sufficient water flow through. Our cowls are made from acrylic and will fit into the slot we have made on the frame. We will also encase our ROV in waste pipe to ensure its safety.

Tether

For our tether, we used 10m Cable. We have water proof taped the different wires making up our tether together so they interfere less with the ROV while it's in the water and have attached floatation along the wire to keep the drag to a minimum.

Control Box

We are using an old tool box for our control panel and have secured all the circuit boards in place by securing a sheet of acrylic over the top and gluing switches in so we can turn each thruster on and off individually.



Camera

We are only using one camera positioned on the bottom of our ROV directly behind the hook so the pilot is able to see how close they are to the objects we need to pick up/ place down. The camera we are using is a fishing camera and it fits well with our shark theme. The camera is connected to an external monitor and is glued into place.

Camera and External Monitor

Hook

Our ROV is equipped with a metal hook that has been bended into the shape required and should be suitable for tasks. This will be fitted to the bottom of the submarine in front of the camera so our pilot can see what he is doing.

Safety

Throughout the construction of our ROV safety was a high priority. We took safety precautions while using the equipment to make our ROV to ensure the safety of fellow team members. The cowls were designed to ensure the water would flow through but also so none of the props or anyone's fingers would get caught in the rotating propellers. We tried to make sure that our ROV had no sharp edges so that it didn't hurt anyone or damage anything in the pool. When adding our hook we decided to have flat points so that there wasn't any sharp edges.

As we are quite a big team we had to be sure we knew who was doing what, as if we all tried to do the same thing it could become a hazard.

Inline protective fuses to protect circuits

Safety circuits

Finances

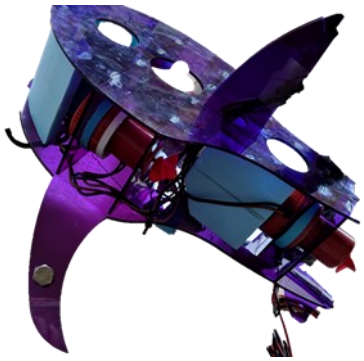
1	Category	Description	Cost or Value	New or Reused
2	ROV Frame	3 Sheets of acrylic	£30	New
3				
4	Thrusters	5 Bilge pumps	£60	New
5				
6	Control Box	5 Switches	£30	New
7				
8	Tether	Wires	£10	New
9				
10	Miscellanous		£20	
11				
12	Competition Cost	Navigator registration cost	£60	
13				
14				
15	Expenses		£210	

Evaluation

Since this was only our second time entering as we had lots of new members, we have developed our skills and have worked really well as a team. We have worked very hard to get our ROV working in the last 3 months.

Our biggest challenge this year is having missed so much time due to the school fire. This has made it really hard for us to get time to work on our ROV as the room we were using is being used for some classes and we could only really work on Aqua Echo during our lunch break. It has also been quite a challenge just to be able to get Aqua Echo ready for the competition. One of other challenges we have is that we have had very little pool time, we have only had an hour in our schools pool due to time constraints.

We have improved our design a lot compared to last year and we think Aqua Echo is more suited to the tasks and will move without as much resistance in the water.



Next year we are hoping we will have more time to improve our design and mostly just more time to practice in the pool, we could also try and redevelop our hook to see if a different one would work better.