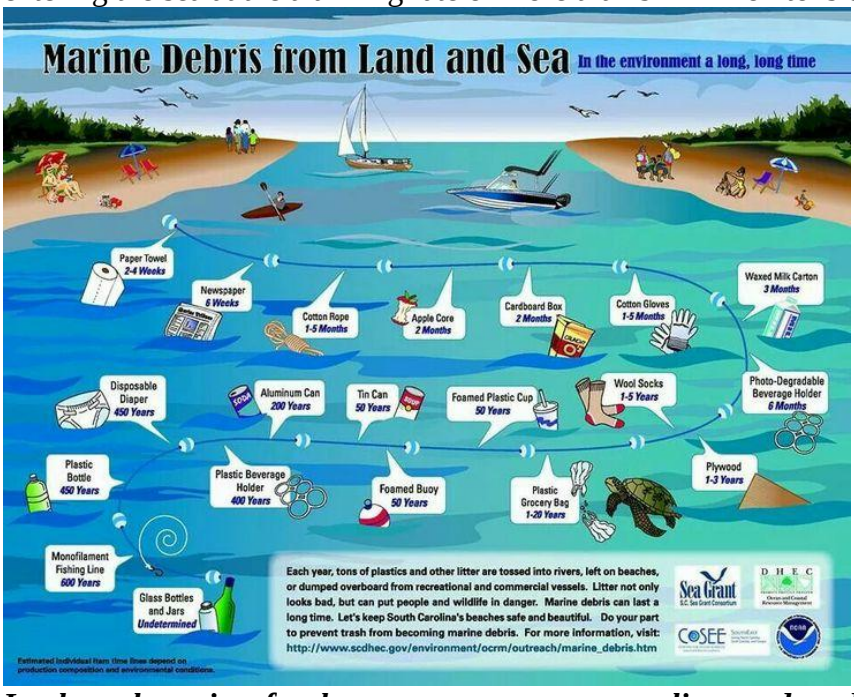
Adventure Class – HK IEEE ROV Regional Qualification.

CONTEXT

Marine debris is an environmental, economic, human health and aesthetic problem. It poses a complex multi-dimensional challenge with significant implications for the marine and coastal environment. Impacts are both cultural and multi-sectoral, rooted primarily in poor practices of solid waste management, a lack of infrastructure, various human activities and inadequate understanding on the part of the public of the potential consequences of their actions, the lack of adequate legal and enforcement systems and a lack of financial resources.

The mess in the ocean and on the shore created by people

Our ocean has become a dumping ground with trash found in all the oceans of the world, not only in densely populated regions, but also in remote areas far from obvious sources and human contact. Every year marine litter takes an enormous social and economic toll on people and communities around the world. From everyday trash like plastic bags, food wrappers and drink bottles, to larger items like car batteries, kitchen appliances and fishing nets, our debris is entering the sea at the alarming rate of more than six million tons each year.



It takes a long time for the oceans to consume our litter and we dump a lot of different things.

Most marine litter consists of material that degrades slowly, if at all, so a continuous input of large quantities of these items results in a gradual build-up in the marine and coastal environment.

A key issue with marine debris is that it is ingested by nearly 36 percent of the world's seabird species and many species of fish, impacting their health with often fatal results. In addition, thousands of other marine animals are killed by waste ingestion or entanglement; it also chokes coral reefs, smothers critical environments and contaminates beaches around the world.
Divers, swimmers and beachgoers can be physically harmed by direct encounters. The costs associated with plastic debris and marine ecosystems are estimated at 13 billion dollars every year.

Many marine animals encounter marine debris often with fatal results.

The United Nations has taken it upon itself to bring this issue to the attention of more governments worldwide via a special awareness program:

REFERENCES

Information in English Language:

WWF (HK): http://www.wwf.org.hk/en/news/press_release/?13340/Coastal-Watch-Takes-on-Lap-Sap-Wan---Reveals-the-extent-of-marine-litter-pollution

NOAA : http://marinedebris.noaa.gov/
https://www.facebook.com/NOAAMarineDebris

Marine Defenders: http://www.marinedefenders.com/marinedebrisfacts/index.php

United Nations Online Course on Marine Litter:

To enroll in the course, please visit https://www.marinelittermooc.org/ or write to: gpa@unep.org

For more information: http://unep.org/training/docs/Marine_Litter_Mooc.pdf

Information in Chinese Language:

RTHK: http://www.liberalstudies.hk/video/programme.php?vid=tcs14-1564

Ocean Park: http://www.oceanpark.com.hk/html/tc/conservation/current-issues/marine-debris.html

Others: (Simplified Chinese):

1/http://www.dw.com/zh/%E5%85%A8%E7%90%83%E6%B5%B7%E6%B4%8B%E5%A1%91%E6%96%99%E5%9E%83%E5%9C%BE%E6%B3%9B%E6%BB%A5/a-18256205

2/http://www.dw.com/zh/%E5%92%8C%E6%B5%B7%E6%B4%8B%E5%9E%83%E5%9C%BE%E4%BD%9C%E6%88%98/a-16743454

NEED

Debris Collection:

There is a need to use ROVs to collect marine debris from the seabed for proper disposal or recycling top side. The ROV should be designed to collect most types of marine debris like soda cans, plastic bags, plastic bottles, ghosted nets, discarded rope, etc. This can be done with a submersible arm or fixed tool attached to the ROV. A light and a camera should be fitted for this purpose.

Scientific Data Collection:

The ROV should be able to carry out an investigation of certain key or indicator species of animals in the area. Collection of corals, sea urchins and crabs should be possible using tools and mechanisms fitted to the ROV. Breeding animals like sea stars should not be disturbed. It should also be able to deploy a temperature data logger for later collection.

DESIGN BRIEF

Below is a summary of the product demonstrations organized by competition class. Unlike 2015, the product demonstrations will not be separated into different runs; all five product demonstrations will be accomplished in one product demonstration run.

Marine Debris(Collect and return to the surface)

- One crushed and one whole soda tin from the seabed.
- Two plastic bags from the seabed
- Two plastic bottles from the seabed
- Two pieces of ghosted fishing nets

Scientific Data Collection

- Retrieve an existing temperature data logger and deploy a new one.
- Collect six coral samples for analysis at the surface.
- Collect two crabs for analysis at the surface.

SPECS

- 12 volts, 25 amps DC. Conversion to lower voltages is permitted topside and on the ROV. Onboard electrical power is not permitted.
- There must be a **25amp fuse in the input power cable** of every ROV.
- A **15m** long umbilical cable is required.
- PWM motor speed control is allowed.
- Manually-powered hydraulics and pneumatics are permitted.
- Pneumatic systems cannot exceed ambient pool pressure.
- Lasers are NOT permitted.
- At least one Camera is required.
- Underwater light is required.
- Maximum size limit: None.
- One person must be able to deploy and retrieve the ROV from the water.
- Arm is allowed.

RESOURCES

Teams are permitted to use the materials of their choice provided that they are safe, will not damage or otherwise mar the competition environment, and are within the defined design and building specifications.

Teams are encouraged to focus on engineering a vehicle to complete the product demonstration tasks; when considering design choices, teams should ask themselves which one most efficiently and effectively allows them to solve the problem. Re-using components built by previous team members is permitted provided that the current team members evaluate, understand, and can explain their engineering and operational principles. Using or re-using commercial components is also permitted, provided that team members evaluate, understand, and can explain their engineering and operational principles. Teams will be questioned extensively on their overall design and component selections during their technical sales presentations.

TIME

The time given for the mission run is 10 minutes.

The expected competition time is 10th April 2016. The venue will be announced.

ADVENTURER MISIONS

The Hong Kong Regional Adventurer procedure & missions for 2016 will be:

3 minute setup and dismantle time and a 10 minutes to complete missions run time.
This competition is for basic Ranger type ROVs. ROV tools may be used and these may be stationary, low pressure hydraulic or motorized. ROV's must be fitted with at least two magnets with one on the lowest point of the machine. Direct switching, electro/mechanical with transistor and PWM (or similar) motor control is allowed. Both a camera and lights must be fitted to this equipment. Operator control feedback of this class must be by camera only.

The mission station will provide 12V @ 25 A power supply for the ROV. Power connection will be via banana plugs or by normal screw terminals. This class must go through the safety check with some infractions allowed. Propellers should be covered with mesh and electrical connections insulated with glue or silicon sealant. The umbilical for this class shall be 15m long.

During the competition:

- There will be a table and three chairs provided at the station.
- The table will be ~2m from the pool edge.
- Only three persons and one photographer may be forward of the table.
- Everyone else must be behind the table.
- The operators are not allowed to look into the pool to steer their robots.
- All operator control feedback must be by camera.
- A single monitor with RCA Video Input shall be provided at the station.
- There are 10 different props that have scoring, so seven missions possible.
- Two magnets will be provided to each competitor.
- Every ROV must have a 25Amp fuse in the main power input cable for safety.
- Power connection will be 4mm Banana type plugs, or wire screw connection.
- Teams will lose points if they try and control their ROV by pulling the tether.

The Missions

1/ Collection of aluminum cans

The ROV will use the fitted with a tool or arm suitable to collect a soft drink can from the seabed. The ROV can then be returned to the pool side for surface recovery of the cans. Note that the ROV must not be dragged back to the pool by the tether. The can retrieving person must only touch the ROV to retrieve the can. A total of 2 cans shall be available at each station. One will be crushed in the middle, the other will not.

2/ Collection of plastic bottles.

The ROV will be fitted with a tool or arm suitable to collect a plastic water bottle. The ROV can then be returned to the pool side for surface recovery of the water bottle. Note that the ROV must not be dragged back to the pool by the tether. The crab retrieving person must only touch the ROV to retrieve the water bottle. There shall be two water bottles per station.

3/ Collection of ghosted fishing net section

The ROV will be fitted with a tool or arm suitable to collect a piece of ghosted fishing net. The ROV can then be returned to the pool side for surface recovery of the ghosted fishing net. Note that the ROV must not be dragged back to the pool by the tether. The net retrieving person must only touch the ROV to retrieve the net. There shall be two ghosted fishing net sections per station. One coarse mesh and the other fine mesh size.

4/ Collection of plastic bag

The ROV will be fitted with a tool or arm suitable to collect a plastic bag. The ROV can then be returned to the pool side for surface recovery of the plastic bags. Note that the ROV must not be dragged back to the pool by the tether. The bag retrieving person must only touch the ROV to retrieve the plastic bags. There shall be two plastic bags per station.

5/ Collection of rope

The ROV will be fitted with a tool or arm suitable to collect a 1m length of rope. The ROV can then be returned to the pool side for surface recovery of the rope. Note that the ROV must not be dragged back to the pool by the tether. The rope retrieving person must only touch the ROV to retrieve the rope. There shall be one piece of rope per station.

6/ *Collection of corals*

The ROV will be fitted with a tool or arm suitable to collect a coral. The ROV can then be returned to the pool side for surface recovery of the coral. Note that the ROV must not be dragged back to the pool by the tether. The coral retrieving person must only touch the ROV to retrieve the coral. There shall be five corals per station and each coral shall be fitted with a small magnet on the top. Magnets may be used to collect the corals.

8/ Collection of sea urchins

These Sea Urchins shall be "O-balls" on the bottom. The ROV will use the fitted hook or tool to catch the Sea Urchin. There shall be two "O-balls" The ROV can then be returned to the pool side for retrieval of the coral. Note that the ROV must not be dragged back to the pool by the tether. The Sea Urchin retrieving person must only touch the ROV to retrieve the Sea Urchin.

8/ Collection of crabs

The ROV will be fitted with a tool or arm suitable to collect a crab. The ROV can then be returned to the pool side for surface recovery of the crab. Note that the ROV must not be dragged back to the pool by the tether. The crab retrieving person must only touch the ROV to retrieve the crab. There shall be two crabs per station and each crab shall be fitted with a magnetic washer on the top. Magnets mat be used to collect the crabs.

9/ Collection and deployment of a data logger

A small battery powered data logger shall be recovered and a new one deployed. The details of the unit will be released shortly. Teams may use any "ROV means" they like to recover and redeploy this unit. Note that throwing the sensor into the pool will not constitute deployment.

10/ Moving around without disturbing other marine life

The ROV will be fitted with a magnet. This magnet shall not be allowed to collect certain marine life also in the mission area. The main animal concerned shall be the sea stars on the seabed. These shall be fitted with a steel washer. Teams will lose marks if they get a sea star stuck to the magnet of their ROV.

On a general note there shall be other debris and marine life placed in the mission area. This distraction should be ignored by the operators.

The Surface Work

There will be marks awarded for the surface work. The breakdown will be issued in an up-date of this document.

1/ Discussion

Each Adventurer Class team needs to make a10min presentation about their ROV to the judges. During this time the judges may ask questions. This presentation may be in the English or Chinese languages or a mixture of both. No PowerPoint or multi-media tools allowed, just a discussion based around the poster. Details of this presentation are below:

- Introduce yourself and the team
- Explain who made what parts of the ROV
- Refer to the poster as the presentation material (no PowerPoint or other multi-media).
- Explain the cool parts in detail.
- Explain the challenges that the team had building the ROV.
- Anything else you want to add.

2/ Poster

Each Adventurer team needs to make a poster about their ROV. The theme of this shall be a reflection on the building of their ROV. This poster shall be in the Chinese or English language or a mixture of the two. The details of what this poster should contain are below:

- Should be A1 size.
- May be made up of sections of smaller sized sheets of paper.
- Title in large letters at the top.
- Name of the ROV & Team clearly shown.
- Photos **with captions!!**
- Illustrations and drawings
- A written description of the ROV

3/ Reflection

Each member of the team should write one or two paragraphs about the experience of building the ROV and working with their team members. This document can be in either Chinese or English language. It may be neatly written or typed. Each reflection piece should have the name, age and school grade / class level on the first line. Several reflection paragraphs can go onto the same page provided they fit. It should have a title page with the team name on it and be bound or stapled down one edge to resemble a book. Students may include drawings or other artwork to highlight the experience. The limit for each student's reflection is one A4 page.

Score Sheet:

Tasks			**Max**
a)	**30 points** - Collection of Aluminum tins (2)		60
b)	**20 points** - Collection of plastic bottles (2)		40
c)	**25 points** – Collection of ghosted fishing nets (2)		50
d)	**20 points** - Collection of plastic bags (2)		40
e)	**30 points** - Collection of rope (1)		30
f)	**10 points** - Collection of corals (5)		50
g)	**25 points** - Sea Urchin (O-ball) (2)		50
h)	**25 points** - Collecting crab (2)		50
i)	**15 points less** - Avoiding sea stars (2)		-30
j)	**10 points** – Collection of data logger		10
k)	**40 points** – Return of old data logger to surface		40
l)	**10 points** – New data logger under control of ROV		10
j)	**40 points** – Successful deployment of data logger in deployment area		40
Penalty Points			
Tether Pulling - Infractions * -5			
Diver Assistance - Infractions * -5			
Leaving Debris in Pool - Infractions * -5			
Total			500