MAChallenge Provisional Rules and Regulations 2020

OCEAN PLASTIC CLEANUP

18 October 2019

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Challenge Focus:OCEAN PLASTIC CLEANUP

1. Objective

Maritime Autonomous Systems (MAS) are of increasing importance to a wide range of sectors, including marine science, offshore resource exploitation, maritime transport and defence and maritime security operations. The UK is a technology leader in this area and the Maritime Autonomous Systems Group (MASG) Council of the Society of Maritime Industries (SMI) aims to enhance this reputation and encourage development and take-up of MAS technologies in the UK. The Maritime Autonomous Systems Group (MASG) Council sets the policy and guides the activities for this market area, utilising the extensive expertise of its council members.

A key part of the MASG Council's mission is to encourage young technologists to help them develop careers that contribute to the future of the UK's MAS industry.

MAChallenge is aiming to highlight the opportunities in the maritime autonomous systems industry and provide a focus for the future innovators that will drive the industry to the next level. MAChallenge is focussed on the autonomy of the platform (irrespective of whether it is an underwater or surface vehicle), not the platform itself.

The objectives of MAChallenge are:

- To stretch the knowledge of the students and promote creative thinking;
- Encourage team working through a variety of individual skills; and
- Connect the brightest young talent coming through the UK's universities with the UK's MAS Industry.

MAChallenge will be achieved by providing a focused challenge, an apparatus, and a venue where future innovators will come together to build, share, and distribute knowledge, and collaboratively expand the envelope of current capabilities.

The focus of the 2020 competition is the identification and removal of plastic from the ocean environment.

The competition is a team event. Teams are to be five strong and must be affiliated to a UK university. Please see section 4 for full information.

2. Competition Point of Contact

Full details regarding the competition are available on the SMI website. You can also email the dedicated address MAChallenge@maritimeindustries.org and the email will be directed to the relevant member of Council, who will endeavour to respond within two working days. However, please check the FAQs on the web site before contacting us!

Our postal address is: Society of Maritime Industries, 28-29 Threadneedle Street, London EC2R 8AY.

3. Competition Outline

MAChallenge 2020 is focused on the identification and removal of plastic from the ocean environment. Using a surface vehicle provided by SMI, teams will develop its autonomous capabilities to achieve the challenges given later in this document.

The challenge is a two stage process:

Stage 1: Team Video Submission
Stage 2: On-water competition

The announcement of the Stage 2 finalists will be made on 23 January 2020.

Those teams successfully selected for Stage 2 will be invited to spend the weekend 19 to 21 June 2020 at Calshot Activities Centre, Fawley, Southampton SO45 1BR for a series of on-water practical challenges. The weekend schedule will be available on the competition website, but may be subject to modification as a result of prevailing weather conditions. Notwithstanding this, the inclusive dates are fixed irrespective of the weather conditions. Each team will be allocated at least one industrial mentor to help guide their development. The mentors will be representatives of the SMI MASG Council with technical expertise and will ensure all teams participate in the spirit of fair competition.

The team finalists will be provided with accommodation and food during the competition weekend at the organiser's cost. Travel costs to Calshot will not be reimbursed.

A prize of £2,000 will be given to the winning team and a consolation award to the remaining finalists.

Key Dates are:

20 December 2019 - Final date for video submissions
23 January 2020 - Announcement of finalists
19-21 June 2020 - On-water competition at Calshot Activities Centre, Hampshire, UK.

For full details and updates including FAQs, please see the SMI website.

4. Eligibility of Team Members:

Each team will consist of **five** people, with four team members being full time undergraduate students registered at a recognised UK university. The fifth member may be a PhD, MSc student or from a different organisation. Faculty staff can advise the team, but cannot be a team member.

The student members of the team are expected to make significant contributions to the engineering development cycle of their solution to the challenge. Faculty staff may be used as advisors but cannot be team members.

For teams who are successfully invited to the challenge weekend, each team should note that a minimum number of three on-site team members are needed for MAChallenge.

Each team must designate a student team member as their team leader. The team leader is the only person allowed to speak for the team, to request vehicle deployment, run start, run end, or vehicle retrieval. All instructions and communications with the MAChallenge organisers will be in English.

5. Registration Information:

If you are interested in participating in MAChallenge, please register your interest here as soon as possible. You will also find a copy of these competition rules, including details of team eligibility here. You may also find our FAQs helpful.

6. Stage 1 - Team Video Submission:

Specific requirements for the video submission can be found on the SMI website.

Each team will need to include the key points:

- Introduce yourself and your team.
- Outline your experience in this field.
- Describe relevant projects that you have worked on.
- Explain what you think the key technical challenges will be and how you will overcome them.
- Describe the role you see for autonomous systems in dealing with the issue of ocean plastics.
- Explain how you would spend the prize money.
- The video will be judged on content not quality of presentation, therefore please do not spend time on finessing the production!

Each video should be no longer than 3 minutes in length and submitted to the SMI website by 12.00 on Friday 20 December 2019. Beware! The judging panel will only watch 3 minutes of video from each entry.

7. Stage 2 – On-Water Weekend:

Overview

The competition will be split into three challenges all of which will be in open water:

Challenge 1 - Manoeuvring and collision avoidance
Challenge 2 - Identifying 'plastics' in water (in reality coloured buoys)
Challenge 3 - A race between the teams

In addition, 10 minutes will be allocated for each team to give a verbal introduction on the methodologies and technologies employed to arrive at their solution to the challenges, and participate in a Q&A, with the judging panel, during the Saturday morning.

Prior to being allowed to compete in the challenges, each team will be required to complete an initial systems test. Teams will be required to show:

- Each vessel is stable and correctly trimmed (i.e. it floats upright and level).
- The vessel is able to successfully engage the propulsion system and control them by travelling up and down the test area in a straight line.

Any vessel deemed by the judges not to be controllable at this pre-assessment will not be allowed to enter their vessel in the challenges.

Outline programme for weekend (provisional)

Date	Time	Activity
Friday 19 June	1400 onwards	Teams arrive and set up equipment in Schneider hanger
	1500	Safety briefing. **All must attend**.
Saturday 20 June	0800	Hanger opens for vehicle preparation
	0900-1300	Initial system test and introductions to judging panel
	1400-1700	Challenge 1: Manoeuvring and Collision Avoidance
Sunday 21 June	0900	Challenge 2: Identifying 'plastics' in water
	1300	Challenge 3: Race between teams by time trial
	1500	Award ceremony and winner announced
	1530	End of formalities
	1700	All materials and equipment to be removed from site by this time

Teams will be welcome to display banners in their working area. Full details will be sent to all finalists in advance on the arrangements for the weekend.

Items provided to each team:

Each team that is successfully selected for Stage 2 and is invited to the on-water weekend, will be provided with the following:

- Catamaran GRP hull (ca. 2m long)
- Propulsion system built into the vehicle. This will consist of two Blue Robotics T200 thrusters and associated electronic speed controller (ESC) providing differential steering.
- Battery for propulsion including a charger.

A number of useful links to information about the thrusters, hull form details etc. will be provided on the SMI website

No modification to the hull or provided equipment may be made. All items added by the teams must only be fitted to the central deck area.

The hull and equipment will be provided to each team at least three months prior to the competition weekend. Teams will need to provide evidence of appropriate insurance e.g. public liability and hull loss insurance prior to release of the hulls for testing. Most universities carry this insurance and teams should, in the first instance, ask their university finance department. However, if any team encounters a problem please contact the organiser.

Team Budget:

The equipment a team acquires to enter the challenge should not exceed £500 in value based on the open market value of the equipment. It is expected that funds for this will be provided by the university. SMI will not fund this expenditure. Each team will be required to submit details of the equipment procured and its value to the MAChallenge organisers by 17 June 2020 showing that this budget has not been exceeded.

Required Capabilities:

Teams are expected to provide most of the following for their vessel:

- Control System that is capable of interfacing with the propulsion system
- Communication system (Wi-Fi, 868Mhz radio or 433MHz radio) providing telemetry data, ability to modify vehicle position, visual data to the ground station
- Emergency stop system to be operated both on-board (kill switch) and off-board via the communication system.
- GPS and ability to record GPS positions
- Heading sensor
- Camera to be mounted on platform with unobstructed forward view
- A means to manually control the vehicle e.g. radio control

All systems are required to be encased in a waterproof container meeting a minimum standard of IP67.

The entire system to be added onto the base platform may not exceed 5 Kg.

8. Mission Challenges:

The competition venue is sheltered water at the junction between Southampton water and the wider Solent. This is shown in Figure 1. The outline course area is highlighted in Figure 2. Specific course details will be provided on the competition dates.

Tidal data for Southampton for Calshot is at Table 1.

Date June 2020		High Water		Low Water		Range
		Time	Height	Time	Height	
		H:M	M	H:M	M	M
19	Fr	10:56	4.2	16:20	1.4	2.8
		23:09	4.4			
20	Sat			04:42	1.2	3.2
		11:35	4.3	16:58	1.3	3.0
		23:44	4.4			
21	Sun			05:19	1.1	3.3
		12:12	4.4	17:35	1.2	3.2

Table 1 – Tidal data for Calshot 19 – 21 June 2020

Figure 1 – Competition Venue

Figure 2 - Course area is approximately 500m by 500m

Main Challenges:

All teams will need to undertake the following challenges. The courses given in the figures are indicative courses and will depend on the weather and tidal conditions on the day. Teams may use remote control with line of sight; telepresence with control screen in remote location; or full autonomy to undertake the challenges with scoring awarded appropriately by the judging panel.

The organiser reserves the right to amend the challenges in the light of operational conditions on the day.

Challenge 1: Manoeuvring and Collision Avoidance

Vehicles will be required to navigate through a series of buoys (fixed markers) in order to test the manoeuvring and collision avoidance abilities. This will consist of an initial straight line between two buoys, travelling around a buoy of known GPS location, then returning with a slalom between buoys of known GPS locations.

Vision, path planning, obstacle detection and avoidance techniques may all (or any combination of the above) be used during this test. GPS coordinates should be collected around the course and in particular on rounding a buoy. Contact with a buoy must be avoided during this task. An indicative course is shown below.

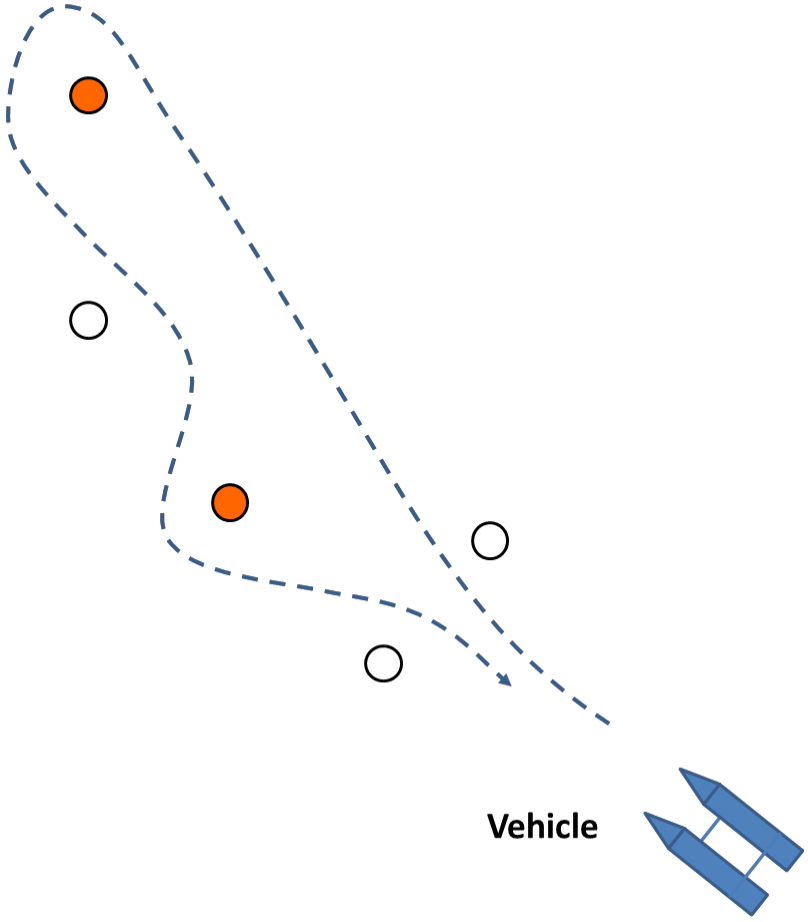

Figure 3 – Challenge 1: Manoeuvring and Collision Avoidance

Challenge 2: Identify “plastics” (buoys of specified colour)

Teams will need to manoeuvre around a course through a series of buoys such as that indicated below and identify all the buoys in the specified colour using on-board computer vision based visual identification systems.

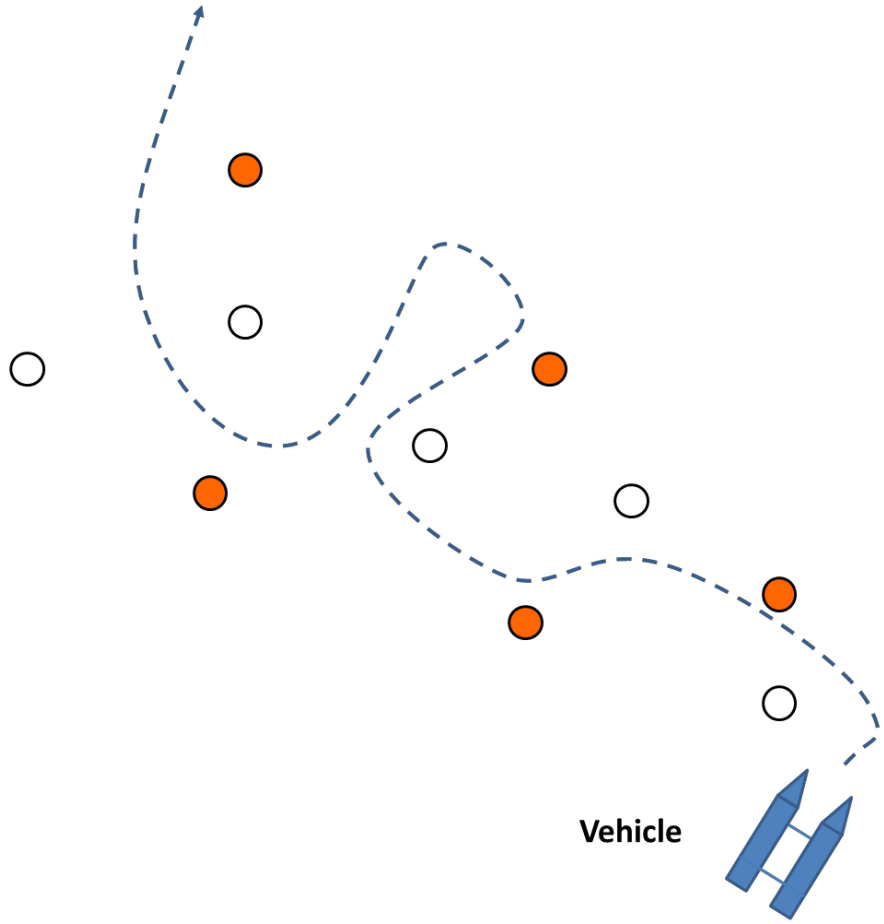

Figure 4 - Challenge 2: Identify “plastics”

Challenge 3: Race between teams

The final challenge is in the form of a time trial. It will be a race from the given start line round the marked buoys and back to the finish line (Figure 5). Deliberate collisions are not allowed. First team back wins!

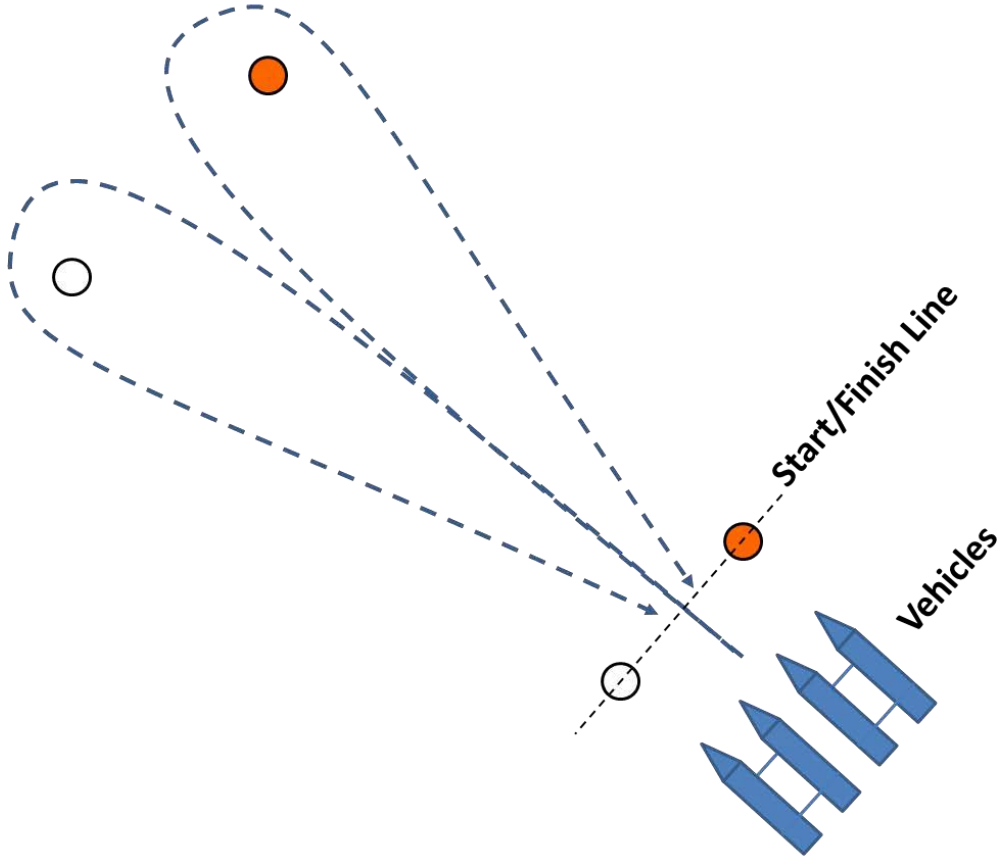

Figure 5 - Race

Provisional Scoring Scheme:

The overall scoring scheme is as follows:

Challenge 1	- 25
Challenge 2	- 35
Challenge 3	- 25
Team Presentation	- 10

Thus, there will be a maximum of 100 points available; however, teams that do not complete a challenge autonomously will have their points reduced by 50% for that challenge. There will also be penalties for collisions with buoys and/or other teams.

Challenges 1 and 3:

The fastest team to complete Challenges 1 and 3 will be awarded maximum points, and subsequent teams on a position basis as per the following scheme:

1st	- 25
2nd	- 20
3rd	- 15
4th	- 10
5th	- 5

Challenge 2:

For Challenge 2, every team successfully completing the course will score 10 pts. In addition, every buoy correctly identified by colour will earn 2.5 points per buoy; meaning that correct identification of all 10 buoys will earn a maximum of an additional 25 points.

Team Introduction and Q&A:

In addition, points for the team Introduction and Q&A with the judging panel on the following basis:

1st	- 10
2nd	- 8
3rd	- 6
4th	- 4
5th	- 2

Judging

Judges have the right to adapt the scoring criteria over the duration of Stage 2 and their decisions are final.

Society of Maritime Industries

Maritime Autonomous Systems Council 2019

Bill Biggs	Senior Campaign Lead – Autonomy	QinetiQ
Joe Chilcott	Principal Systems Design Engineer	L3 MAPPS UK
Frank Cotton	Head of Technology, Combat Systems	BAE Systems Naval Ships
David Etherington-Smith	Sales Manager	EP Barrus
Kevin Forshaw	Director of Industrial and Strategic Partnerships	University of Plymouth
Matt Hunt	MAS Lead	Thales UK
Neil Hunt	Business Manager	Frazer-Nash Consultancy Ltd
Tim Kent	Technical Director	Lloyd's Register
David Maclean	Director	AutoNaut
Colin McMurray	Director	Clyde Marine Training
Ahmed Moosa	IBS Systems & Compliance Manager	Kelvin Hughes Ltd
Ryan Mowat	Scientific & Technical Sales	RS Aqua
Tim Munn	Head of Sales & Marketing	ABB Marine & Ports UK
Frederic Perdrix	Chief Technical Officer	Houlder Ltd
Wayne Ross	CEO	Servowatch Ltd
Nick Smedley	Business Development Manager	Valeport Ltd
Andy Smerdon	Managing Director	Aquatec Group Ltd
Aidan Thorn	MRIC Manager	NOC
Stephen Turnock	Head of Fluid Structure Interactions Group	Southampton University
Iain Vincent	Business Development Manager	Planet Ocean
Geraint West	Global Business Manager	Sonardyne International Ltd
Nigel Whybrow	Future Submarines & Technology Director	Babcock International
Julian Woolley	Head of Business Development	BMT Asset Performance

Co-opted:

James Fanshawe	Chairman	MAS Regulatory Working Group
Richard Westgarth	Head of Campaigns	BMT Group

Ex Officio:

John Murray	Chief Executive	Society of Maritime Industries