World Robotic Sailing Championships 2014

Introduction
The committee of the **World Robotic Sailing Competition 2014**, invites teams of up to six members per team, from any organisation, including private individuals, schools, colleges, universities and companies, to enter the competition. Registration will be via the WRSC 2014 web site, http://wrsc2014.com/

All events will take place within Galway Docks, Lough Atalia, the Claddagh Basin or else if weather permits, within Galway Bay.

Liability and Safety
All boats must be controllable by a designated human helmsman throughout all events. The responsibility for avoiding any collision and/or damage will rest solely with the respective teams. All teams are responsible for their own safety during the event. The organisers will not assume any liability with respect to damages resulting from a team participating in the WRSC.

Any teams who wish to monitor or control their boat from a safety RIB, must follow the safety instructions of the RIB driver, must provide their own personal floatation device which must be worn at all times while on the water, and are limited to a maximum of one person per team. The safety crews reserve the right to manage the fleet of support boats, and can refuse access to the support boats, in certain circumstances.

Similarly, any team member entering the restricted areas in the Galway Docks must follow the safety instructions of the shore crew, and must provide their own personal floatation device which must be worn at all times while in the restricted area. The shore captain reserves the right to refuse access to the restricted area.

Scoring
For each individual event, a boat gets scored depending on its performance. Manual control to avoid a collision shall not count as human intervention if it is limited to minimal intervention to perform collision avoidance. Boats using some method for automatic collision avoidance and completing a contest without manual intervention to avoid a collision will be awarded two bonus points in the respective score. Scores will be posted on the WRSC web site, each day. We will endeavour to provide real-time score updates, where possible.

Collisions and Right of Way
Autonomous boats have right of way over manually controlled boats. In the event of a potential collision, then COLREGs rules must be followed (for example, a boat on a starboard tack has right of way, etc). However, all competitors must take appropriate steps to avoid collisions and having right of way is not an acceptable excuse for allowing a collision to take place.

Tracking
All boats should attempt to transmit their position to the World Server at an interval of between 1 and 5 seconds. Radio interference and range may at times prevent this and the World Server should not be viewed as a 100% reliable source of data. The organisers will endeavour to make the server accessible via the Internet both for the purposes of viewing data and submitting positions.

World Robotic Sailing Championships 2014

The Organising Committee will provide a transmitter or transceiver for each registered boat ahead of the first days events.

Classes
The World Robotic Sailing Championship is open to boats in three distinct classes, as follows:

Micro-sailboats Category (MS)
Small autonomous sailboats up to 1 metre LOA, 2 metres high (keel tip to mast tip) and weighing no more than 100kg.

Sailboats Category (S)
Autonomous sailboats which do not fit in the micro-sailboats category, up to 4 metres LOA, 5 metres high (keel tip to mast tip) and weighing no more than 500kg.

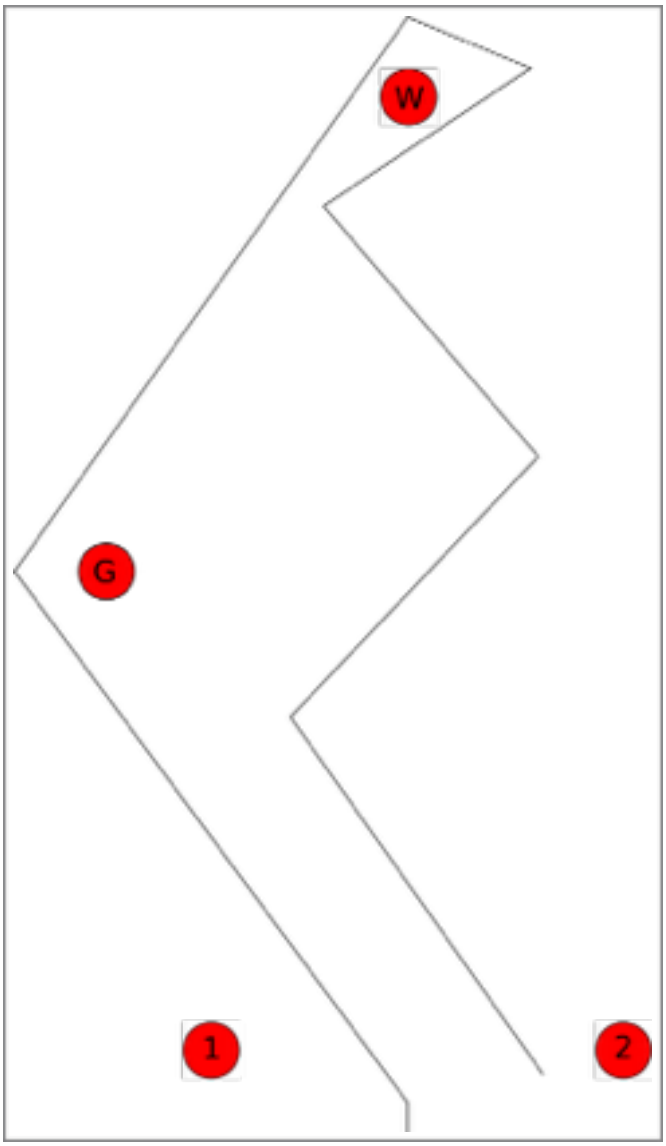
Motorboats Category
Any type of autonomous boat apart from those in the micro-sailboat or sailboat category, up to 4 metres LOA, 5 metres high (keel tip to mast tip) and weighing no more than 500kg.

Starting Procedure
Unless a different procedure is posted on the WRSC site no less than 12 hours before any given event, the starting sequence will be defined by sound signals given 5, 4, 2 and 1 minute before the start, along with a longer sound signal for the start. Additionally, a special object (StartBoat) sent by the WorldServer may also be shown/sent. After the 1 minute signal, all boats must be in autonomous mode or they will incur a 50% penalty. Boats deemed to be over the start line before in the final minute before the start signal will incur a 25% time penalty if it is deemed the boat gained an advantage.

Event Descriptions
The following events will be staged in and around Galway Bay. The exact date and time, as well as location of each event, will be published on the WRSC web site no less than 12 hours before the start of the event.

World Robotic Sailing Championships 2014

Courses
All events except for the station keeping contest and the endurance race, will use the triangular course shown on the right.



The positioning of the buoys will be indicated by the WorldServer during the race, and will also be made available to the teams.

TUESDAY, 9 SEPTEMBER, 11:00

Upwind / Downwind Speed Contest
The upwind/downwind speed test involves covering an upwind course autonomously, as fast as possible. It is expected that three or more boats will sail & compete at one time. Boats will sail/motor from the start line 1-2 to the windward mark W, a distance of approximately 400m or shorter to finish within time limit (100m for MS category). The start line will be on the order of 10 to 20 metres long from Mark 1 to Mark 2. Boats do not need to round the windward mark, but must be within 5 metres of it, before turning downwind. Boats must finish within 30 minutes of starting. The GPS tracker log will be used to calculate the maximum and average speeds. The gybe mark G does not form a part of this course and may not be in the water.

Points will be awarded in each class based on the time taken to complete the challenge, adjusted using the formula:

$$T_{adjusted} = T_{elapsed} / \mathrm{sqrt}(LWL)$$

The first boat to finish, on adjusted time, will be awarded 10 points. The second boat will be awarded 9 points, and so on. Boats which complete the course correctly will be awarded a minimum of 4 points. Boats which cross the start line but which do not round the mark windward mark, or which fail to finish, will be awarded 1 point.

Use of manual control, except in the case of collision avoidance, after the 1 minute preparatory signal, and before the finish, will result in a score of zero points.

As time permits, two or more attempts at this event will be held. The final scoring will be the average of the results, discarding the worst result of the day (assuming more than two attempts are held).

World Robotic Sailing Championships 2014

WEDNESDAY, 10 SEPTEMBER, 10:00

Station-Keeping Contest
It is expected that more than one boat will compete at one time. The objective of the station keeping contest is to evaluate controlled sailing in a limited region with time constraints. Each boat must start outside a 40m x 40m box, marked by four buoys. After the start signal, the boat must enter the box as quickly as possible. 5 minutes after the start, the boat must leave the box as quickly as possible. Boats fulfilling the entry and exit criteria are awarded points based on the following formula:

$$P = \max(0, 300 - (T_{start} - T_{enter}) - (T_{end} - T_{leave})) / 30$$

Where T_{enter} is the timestamp when the boat first enters the box, T_{leave} is the timestamp when the boat first leaves the box, and T_{start} & T_{end} are the timestamps when the 300 seconds start and end counting, respectively. All timestamps are given in seconds.

Use of manual control after the preparatory signal and before the finish, will result in a score of zero points.

As time permits, two or more attempts at this event will be held. The final scoring will be the average of the results, discarding the worst result of the day (assuming more than two attempts are held).

WEDNESDAY, 10 SEPTEMBER, 14:00

Fleet Race
The course will be comprised of a triangular course as shown above, at least 400m in length (and as decided by the race officer, based on conditions). All boats will start and compete together. The MS class will be given a shorter course. A mark is considered to be rounded once a boat is within 10 metres of it. After the start signal, boats will race to the windward mark, round it to port, sail or motor to the gybe mark, rounding it to port also, and return to the start/finish line 1-2.

It is anticipated that the course will be suitably long enough for the fleet race to take at least one hour to complete.

Finishing times will be computed as for the upwind/downwind course as started previously. The boat which finishes in first place will be awarded 16 points, with the second-placed boat awarded 15 points, and so on. Successfully rounding the windward mark will score an additional 2 points. Likewise, successful rounding of the gybe mark will score an additional 2 points for a maximum of 20 points for the challenge. Boats which successfully complete the course by coming within 10 metres of the marks and finishing correctly, will be awarded a minimum of 5 points. Boats which start but do not complete the course will be scored 2 points.

Use of manual control, except in the case of collision avoidance, after the 1 minute preparatory signal, and before the finish, will result in a score of zero points.

As time permits, two or more attempts at this event will be held. The final scoring will be the average of the results, discarding the worst result of the day (assuming more than two attempts are held).

THURSDAY, 11 SEPTEMBER, 10:00

Endurance Race
The course for the endurance contest will be set depending on the wind conditions and generally the rules for the fleet race will apply, except that the marks will be positioned in such a way as to bring the fleet safely through the course. All boats will start and compete together. A mark is to be considered to have been rounded once a boat is within 10 metres of it.

Two long routes will be chosen, no later than 12 hours before the official start time of the challenge. One route will be no more than 4nm and one will be no more than 10nm. Scoring will be on corrected time as per the upwind/downwind speed test above. Boats may choose to compete in the short course or the long course. However, any boat which has not completed the course within 8 hours (elapsed time) will be deemed to have not finished the race.

The first finisher on corrected time, on the short course, will be awarded 12 points. The second finisher will be awarded 11 points, and so on. Boats which start the challenge but which don't finish, will be awarded 2 points.

The first finisher on corrected time, on the long course, will be awarded 20 points. The second finisher will be awarded 19 points, and so on. Boats which start the challenge but which don't finish, will be awarded 2 points. A boat can restart if it is withdrawn, but the boat must start again from the start line and no extension to the overall time limit will be allowed. A boat may re-start the race until no later than ninety minutes after the race start time.

Boats may be equipped with solar panels, wind turbines or fuel cells (or other recharging technologies) to recharge their batteries on board. Batteries shall not be replaced at any time during the race.

Use of manual control, except in the case of collision avoidance, after the 1 minute preparatory signal, and before the finish, will result in a score of zero points.

FRIDAY, 12 SEPTEMBER, 11:00

Collision Avoidance Contest
The collision avoidance challenge evaluates basic avoidance of obstacles without manual intervention. It is expected that three or more boats will sail and compete at one time. The boat shall be set up to sail on a port tack on a beam reach (true wind angle of approximately 90 degrees) through two marks to round another mark at least 200m away from the start line and return between the two start marks. After the 1 minute preparatory signal, no manual interaction with the boat will be permitted. Shortly before the start, an obstacle will be placed on the course. The position and size of the obstacle will be available through the World Server. A boat that fully autonomously and without using the World Server, avoids the obstacle, will be scored 10 points. A boat which fully

autonomously, with the aid of the World Server data, avoids the obstacle, will be scored 7 points. A boat which avoids the obstacle in one direction only (on the way to or from the mark) will be scored 50% of the points.

This event must be completed autonomously.

Time Limits
Where time limits are set and in the event of light winds, the Race Committee may shorten the course prior to the start, to ensure that all boats have a reasonable chance of completing the course within the time limit.