The 7th International Robotic Sailboat Championship

9-13 June 2013

Event Outline
Notice of Competition and Sailing Instructions

Hosted by:
Olin College and the City of Gloucester, MA

The 7th International Robotic Sailboat Regatta

Event Outline - 2013

Competition Overview

The International Robotic Sailboat Regatta is open to teams wishing to design, build and compete with robotic sailboats. Olin College and the City of Gloucester will host the event from June 9 to 13, 2012 in the harbor of Gloucester, MA.

Background

In 2004 students from the University of British Columbia demonstrated as part of a fourth-year design project that an autonomous sailboat was possible. Based on their work the SailBot Class rules were developed for friendly competition among university teams. The first SailBot International Championship was held in 2006.

Competitions have been held in Canada and the United States. The winner of the event has the responsibility to select the next host site in North America. In 2010 the U. S. Naval Academy won in Kingston, Ontario and hosted the 2011 event. After winning again in 2011 the U S Naval Academy selected Vancouver as the site for the 2012 event. UBC won in Vancouver and selected Olin College as the host for the 2013 Championship.

The detailed rules of competition are in the Sailing Instructions; however, the basic concept is to build a boat up to 2 meters long which can sail autonomously by making its own on-board decisions about sail trim and course direction without human assistance. Due to the complexities involved in this task, only one scored event will be required to be fully autonomous. At the cost of some points the other events permit the rudder and sails to be controlled from off the vessel. There will also be a non-scored autonomy “demonstration” event. This allows teams to gradually increase the complexity of their boat. For instance, a first-year effort would be to build a boat and possibly an autonomous sail trim system. Also, for safety reasons one event stresses reliable standby manual remote control.

Events

The competition will consist of six parts (five of which are scored) to test various aspects of the design, construction and control logic.

1. Fleet Racing (manual rudder and/or sail control incurs no points penalty)
2. Station keeping to test logic (manual control incurs 50% points penalty)
3. Autonomous navigation contest to test precision (no manual control allowed)
4. Judges evaluation of a presentation on the design, construction and innovation
5. Long Distance Race (manual control incurs loss of point per leg where manual control is used)

6. Autonomous Chase Race (boats chase each other until one catches up with the other). Demonstration only for 2013.

Weather

Gloucester sailing weather
http://www.wunderground.com/MAR/AN/250.html

Figure 1 Olin SailBot passing by the USS Constitution

June in Gloucester Harbor is historically mild with lows in the 50's and highs in the low 70's and breezes of approx. 10 mph in the afternoons. However, this being New England, it is best to expect almost any kind of weather.

Team Spirit

While competing and to encourage team spirit, competitors are encouraged to wear clothing that identifies them with their school and/or team.

Accommodations and Travel

The City of Gloucester is approximately 40 miles from Logan Airport, Boston, MA. Endicott College, approximately 20 minutes away from the harbor, has graciously

offered rooms for the competitors in Stoneridge Hall. There are also multiple B&B's and hotels in the City of Gloucester.

Design Assistance

Information describing sailbot development is located at:

http://www.usna.edu/Users/naome/phmiller/SailBot/SailBot.htm
http://olinsailbot.com/
http://www.usna.edu/Users/naome/phmiller/SailBot/SailBot.htm (look under "Papers").

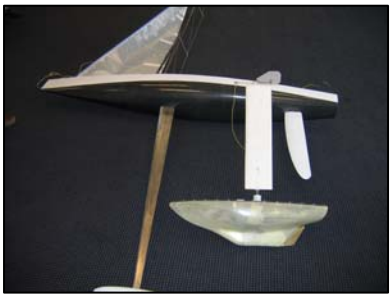
Also, there are is a growing list of resources on the 2013 event website at:

http://www.sailbot.org

The papers include enough information for a team to design and build a competitive SailBot. Some teams have designed and fabricated their own hull while others have purchased hulls for RC boats and modified them into robots.

Contact Information/Website

If you are interested in finding out more about the competition or SailBots in general, please contact us at: SailBot2013@gmail.com



SailBot 2013 – Notice of Competition & Sailing Instructions

Rules

This year the competition shall be governed by the SailBot Class Rules, the Simplified Racing Rules of Sailing (at the end of this document), this Notice of Competition and Sailing Instructions. The SailBot judges are the final arbiters in any dispute.

Organizers

The event is organized by the Olin College of Engineering in cooperation with the City of Gloucester.

Eligibility

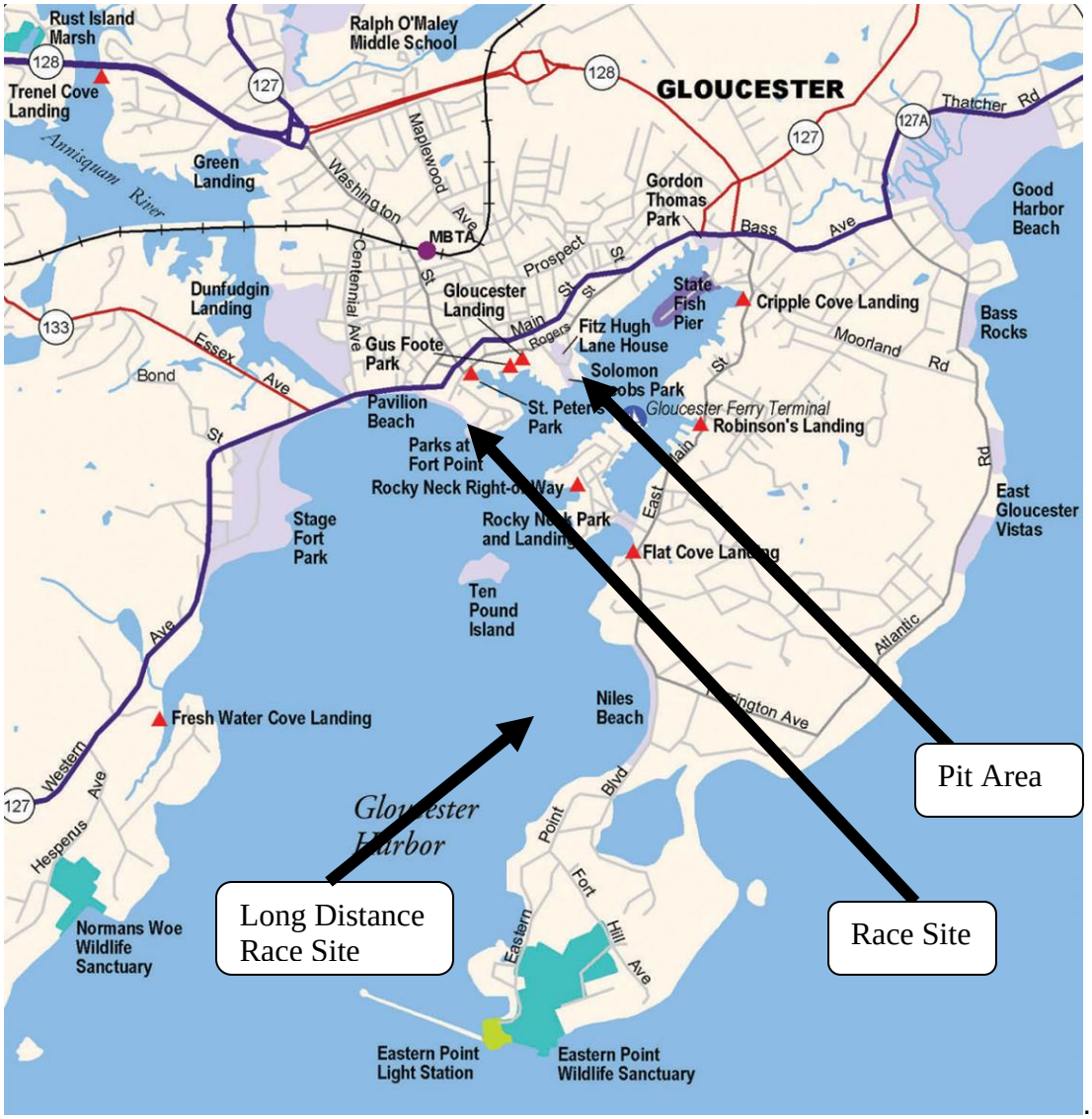
For the SailBot Class at least 50% of all team members must be students enrolled in a secondary or post-secondary undergraduate institution. Faculty Advisors are not included in the calculation of team membership. The remote yacht, its hull(s), sail(s) and control systems must be substantially an original design, subject to the scrutiny of the judges. Kit boats and controls are permitted but are subject to reduced points in the Presentation Event.

Attendance

High school teams must have an adult chaperone accompanying them to the competition.

Location

All sailing competitions will be held in Gloucester Harbor. The majority of races are anticipated to take place in the areas between Pavilion Beach and Fort Point. Alternative race locations will be made available should weather make it necessary.


Rust Island Marsh
Ralph O'Maley Middle School
GLOUCESTER
Trenel Cove Landing
Annisquam River
Green Landing
Washington
Maplewood Ave
MBTA
Gordon Thomas Park
Thatcher Rd
Bass Ave
Good Harbor Beach
Dunfudgin Landing
Centennial Ave
Prospect St
Gloucester Landing
State Fish Pier
Cripple Cove Landing
Bass Rocks
Main St
Rogers St
Fitz Hugh Lane House
Moorland Rd
Essex Ave
Bond St
Gus Foote Park
Solomon Jacobs Park
Pavilion Beach
St. Peters Park
Gloucester Ferry Terminal
Robinson's Landing
Parks at Fort Point
Rocky Neck Right-of-Way
East Gloucester Vistas
Stage Fort Park
Rocky Neck Park and Landing
Flat Cove Landing
Ten Pound Island
Atlantic
Niles Beach
Fresh Water Cove Landing
Western Ave
Hesperus
Gloucester Harbor
Point Fort Blvd
Eastern Hill Ave
Normans Woe Wildlife Sanctuary
Eastern Point Light Station
Eastern Point Wildlife Sanctuary
Pit Area
Long Distance Race Site
Race Site

Shipping

Boats, materials, etc. may be shipped directly to the SailBot staging venue. Please address any shipments as follows:

Maritime Gloucester
ATTN: SAILBOT 2013
23 Harbor Loop
Gloucester, MA 01930

(978) 281-0470

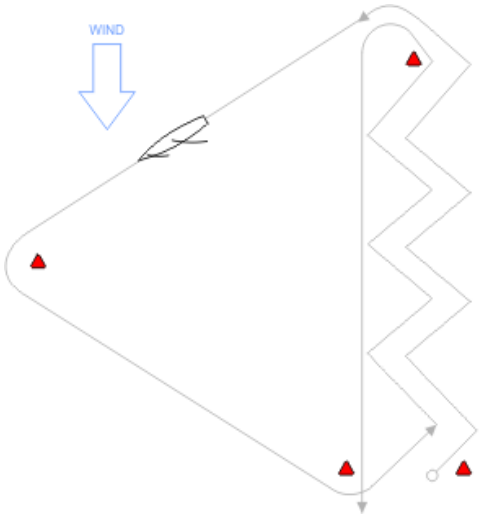
Please notify the SailBot organizers (sailbot2013@gmail.com) when shipping packages. That way we will know to look out for them!

Competition Events

The competition will consist of four on-water competitions and one on-shore event to test various design attributes.

1) Fleet Race Event - (Maximum points: 10)

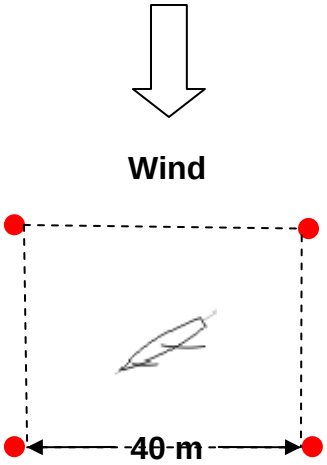
The entire fleet will race together on the course shown below. Due to the close quarters of this event, to minimize the risk of collisions, boats are expected to sail with manual rudder control. No penalty will be applied if autonomous rudder control is used, however all competitors are reminded that they must comply with the *Simplified Rules of Sailing, amended for SailBot* (see end of this document) in regards to the rights-of-way of vessels. Boats may race with either manual or automatic sail control. Two races are planned for the event, with the final placing of boats based on the lowest overall race time for the two combined races. Boats that fail to complete a race will be assigned a race time of twice the time of the slowest boat to finish that race. Scoring for the fleet races will be as follows: 1st place boat will score 10 points, the second place 9 and so on down to the 10th place boat scoring 1 point.



Note: The direction of mark rounding will be announced not less than 5 minutes before the starting signal.

2) Station Keeping (Maximum points: 10)

Boats will sail into a 40 m x 40 m "box" formed by four buoys. The boats are to remain in the box for five minutes, then exit the box. Boats that complete these requirements will score 9 points. If a boat leaves the box its score will be proportional to the amount of time it is in the box during the five minute period, rounded to the nearest tenth of a point. For example, if a boat remains in the box for three of the five minutes it will score 5.4 points. The boat sailing autonomously that stays in the box the least amount of time over five minutes will receive a bonus of one point. In other words a bonus is given for a quick exit. Manual rudder or sail control after the boat enters the box will incur a 50% penalty for all points scored in this event. The minimum score for a boat that enters and leaves the box, regardless of whether manual or autonomous is two points. Subject to time available, boats may make multiple scoring runs in the station keeping contest. Starting priority will be given to the boat with the least number of completed runs. If the number of completed runs is equal, priority will be given to the boat with the best score in the first fleet race. Only one boat will be allowed in the box at a time.

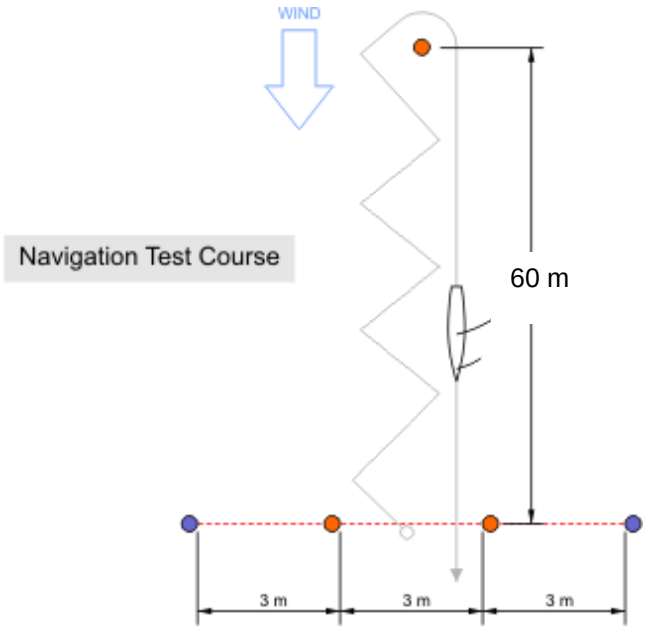


3) Navigation Test (Maximum points: 10)

This event will be performed with the boat in full autonomous mode. No external control of the boats is allowed once the boat has crossed the start line. Each boat will be required to sail between the two central start marks, complete an upwind leg of approximately 60m, round a mark and pass back through the start marks. There is no penalty for touching any of the marks. Boats will score points according to the following:

- Accuracy: 8 points for finishing between the central start marks, 6 points for finishing between the outer marks, and 4 points for crossing the finish line outside all marks.

- Mark Rounding: 2 points for rounding the windward mark in the correct direction. – A boat has rounded the windward mark when, after bearing away around the mark, any part of her equipment passes through a line extending from the mark perpendicular to the leeward leg



Notes:

a) Direction of windward mark rounding will be announced on the day of the event.
b) There will be no obstructions within 10m of any mark.
c) Boats must ask Race Official for permission to enter the navigation course area.
d) With permission of the Race Officials, boats may make non-scoring trial runs over the Navigation course.
e) Boats may make only two official scoring runs and use their best result for scoring purposes. Boats must declare to Race Officials before they are about to start an official scoring run. Priority on the course will be given to boats that are starting their first scoring run. For boats that have started an equal number of runs priority will be given to the boat with the best score in the first fleet race.
f) If in the opinion of the Race Officers, weather conditions have unduly prejudiced the result of a boat in a Navigation run, the Race Officers may grant that boat an additional run.
g) At the discretion of the Race Officers, more than one boat may be allowed on the course at a time. In that case right of way shall always be given to the boat that entered the course first.
h) Any boat using manual control for collision avoidance with a boat underway must abandon her run and may re-sail that run later without penalty.

4) Presentation (On-Shore Event) (Maximum points: 10)

Each team will present their boat to the panel of judges. In the SailBot Class the presentation must be completed by secondary or undergraduate students. The intention is that the presentation be informal so no particular format is required. However, the judges should be able to grasp how the boat was designed, built, and tested. Feel free to bring a poster or binder of pictures and drawings to help explain the design or construction process. A projector will be available. The Judges panel will award a maximum of 2 points for each of the following:

1. Aesthetics and workmanship
2. Innovation (in design and/or manufacture)
3. Control theory (completeness and robustness)
4. Student involvement in the project – how much did the students complete themselves? Note that work completed by prior year teams will not count when determining work done by a current team.
5. Design and testing methodology

Each team's score for this event will be the total of their point scores from the Judges for each of the five areas listed above. Points will be rounded to the closest 0.1 point.

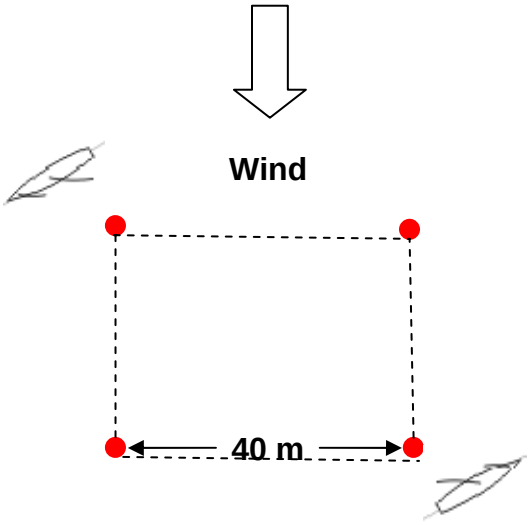
5) Long distance race (Maximum Points 10)

The approximately 10 km race will be sailed in Gloucester Harbor. The race will consist of a closed-loop course with 8 legs. The layout, start and finish line and marker locations will be marked and communicated to all teams upon their arrival at the SailBot 2013 contest. The race consists of eight "legs." Each boat will score 1 point for each leg it completes, for instance from the Start/Finish Line to Mark #1. A boat completes a leg when, after passing within 10 M of the previous mark, she sails to within 10M of the next mark (or rounds the respective marks if sailing under manual control). Boats may contact marks without penalty. During the race, teams score a point for each leg completed. For this event, boats sailing autonomously may be considered to have "rounded" the mark if they pass within 10 meters of the mark, including the start/finish line. If a boat misses a mark, it must be manually steered to within 10m of the missed mark and returned to autonomous control before the next leg is attempted. Note that the prior (missed-mark) leg will not get a point. The boat that completes the entire course autonomously in the shortest elapsed time after the starting signal will score two bonus points and the autonomous boat that finishes with the second fastest elapsed time after the starting signal will score one bonus point. Boats may temporarily use manual control to avoid moving objects or drifting hazards to navigation without penalty. A boat sailing autonomously may use R/C control briefly to take a 720 penalty turn under Simplified Rule #10 without further penalty. Use of manual control to avoid stationary objects such as piers, shallows or other fixtures will result in loss of the point for that leg. There is no handicapping for this event. The time limit is 6 hours. Note that the straight line course between marks will keep the boats out of shallow water. The course does have obstructions such as aids-to-navigation. Teams are encouraged to consult a nautical chart. In addition, prior to the event, teams will be allowed a minimum of one hour to tour the course by power boat.

Demonstration Event

To promote the continued growth of the race and to maintain relevance with the current state of marine technology, un-scored demonstration events will be open to all competitors. If the event proves satisfactory, it will be considered for incorporation into the Competition Events.

This year the demonstration event will be a "chase race." This is a fully autonomous race. Two competitors will begin at opposite corners of a box formation of four buoys. The boats will then chase each other in a clockwise direction about the box for not more than 15 minutes or until one boat catches up with the other; the boat that catches up with the other will be declared the winner. In the event that 15 minutes have elapsed with no clear winner, then the boat that has moved closest to its competitor will be declared the winner. The box is considered a "no go" zone; any boat which crosses inside the box will immediately be declared the loser of that match.



Tentative Schedule

The competition shall be held over four days. The final order of events is dependent on weather conditions. Unless agreed upon by all teams, on-the-water events will not be started if the average wind speed is 15 knots or above for a period of 20 seconds during the 15 minutes prior to the scheduled start. Races in progress will be cancelled if the wind speed exceeds 20 knots for more than 30 seconds. Races will not be started if the wind speed is less than 2 knots. The regatta headquarters will be located at Maritime Gloucester, 23 Harbor Loop Gloucester, MA 01930.

April 1, 2013	Deadline for indicating intention to compete including a Design Summary Sheet.
Sat./Sun. June 8 & 9	Optional pre-event practice days

Sunday, June 9	1800 Informal BBQ at Maritime Gloucester for all competitors.	
Monday, June 10	Registration & Measurement	(0900-1000)
	Fleet Race #1	(1100-1200)
	Station Keeping Contest	(1300-1800)
Tuesday, June 11	Presentations	(0900-1200)
	Navigation Contest	(1300-1800)
Wednesday, June 12	Fleet Race #2	(1000-1200)
	Make up events as needed*	(1400-1800)
	Demonstration Event	(1400-1800)
Thursday June 13	Long Distance Race	(1000-1600)
	Awards dinner at Hammond Castle (tentative)	(1800-2200)

* The “make-up” period is intended primarily for events that were not completed due to unacceptable weather conditions. It may also be used, if time permits, to allow teams a chance to complete their Station Keeping or Navigation events. Additional makeup periods may be scheduled as time permits on Wednesday and Thursday for the Navigation and Station Keeping contests.

Changes
By mutual consent of all the teams a competition may be moved or modified.

Judging
Each team is entitled to appoint one (1) judge to the panel. Judges must be professors or instructors in the Faculty of Engineering with a strong grasp of naval architecture, robotics, and/or systems engineering concepts. Other members on the panel of judges will include up to three industry professionals appointed by the host team, reflecting experience in the software, naval architecture, SailBots or other skills.

Scoring
The team that scores the most total points from all four events (fleet races, navigation, station keeping and long-distance) shall be the winner. In the event of a tie, a match race will be held without handicapping to resolve the tie.

Chase Boats
The hosts will provide chase boats for use by the teams for the practice days and for each day of competition. Drivers will be provided.

Prizes

The perpetual trophy was donated by Queen's University and will be presented to the winning SailBot team. Keeper trophies will be presented for the overall event winner, the winners of each SailBot competition and for other achievements.

Protests and Fair Play
A boat and team shall compete in compliance with recognized principles of sportsmanship and fair play. A boat may be penalized under this rule only if it is clearly established that these principles have been violated. A disqualification under this rule, as specified by the jury, in any event shall disqualify the team from all other events.

By participating in an event conducted under these rules, each team agrees to:

a) be governed by these rules, the Simplified Rules of Sailing, and the Sailbot class rules;
b) accept the penalties imposed and other actions taken under the rules.

Intent to Compete
Teams intending to compete shall inform the host institution prior to April 1st 2013
Each team shall submit with their registration a completed design summary form as attached to this document.

Entry Fee There is no entry fee.

Design Summary

School/Firm:

Boat Name:

Team Members:

Faculty Advisors:

Length: m (in) Beam: m (in) Displacement: kg (lb)

Draft: m (in) Sail Area: m^2 (ft^2)

Team History:

Boat Design Summary:

Navigation System Summary:

Sail Control System Summary:

Predicted Tides for Gloucester, MA
June 8-13, 2013

Source:
http://www.toptides.com/MA/2013/june/Gloucester_Harbor-Massachusetts.html

DATE	HIGH				LOW					
	AM	hgt	PM	hgt	AM	hgt	PM	hgt	rise	set
2013-06-08	12:06 PM EDT	8.52			5:47 AM EDT	0.17	5:51 PM EDT	1.14	5:04 EDT	8:18 EDT
2013-06-09	12:09 AM EDT	9.58	12:46 PM EDT	8.52	6:27 AM EDT	0.16	6:32 PM EDT	1.15	5:04 EDT	8:19 EDT
2013-06-10	12:48 AM EDT	9.55	1:25 PM EDT	8.51	7:05 AM EDT	0.19	7:13 PM EDT	1.19	5:04 EDT	8:19 EDT
2013-06-11	1:27 AM EDT	9.47	2:04 PM EDT	8.50	7:44 AM EDT	0.26	7:54 PM EDT	1.24	5:04 EDT	8:20 EDT
2013-06-12	2:08 AM EDT	9.35	2:44 PM EDT	8.50	8:24 AM EDT	0.35	8:36 PM EDT	1.30	5:04 EDT	8:20 EDT
2013-06-13	**2:49 AM EDT**	**9.19**	**3:24 PM EDT**	**8.51**	**9:05 AM EDT**	**0.46**	**9:20 PM EDT**	**1.35**	**5:04 EDT**	**8:21 EDT**
2013-06-14	3:32 AM EDT	9.01	4:07 PM EDT	8.57	9:47 AM EDT	0.58	10:06 PM EDT	1.36	5:04 EDT	8:21 EDT
2013-06-15	4:18 AM EDT	8.83	4:52 PM EDT	8.68	10:32 AM EDT	0.68	10:56 PM EDT	1.31	5:04 EDT	8:22 EDT
2013-06-16	5:07 AM EDT	8.68	5:39 PM EDT	8.88	11:19 AM EDT	0.75	11:49 PM EDT	1.15	5:04 EDT	8:22 EDT
2013-06-17	5:59 AM EDT	8.60	6:29 PM EDT	9.16	12:09 PM EDT	0.77			5:04 EDT	8:22 EDT
2013-06-18	6:54 AM EDT	8.60	7:21 PM EDT	9.53	12:44 AM EDT	0.86	1:02 PM EDT	0.70	5:04 EDT	8:23 EDT

Simplified Racing Rules of Sailing

(amended for SailBot)

1. Port-tack boat shall keep clear of starboard-tack boat.
2. Windward boat shall keep clear of leeward boat.
3. Boat clear astern shall keep clear of boat clear ahead (both boats on same tack).
4. A boat tacking shall keep clear of all other boats.
5. A boat shall endeavor to avoid contact even when having right-of-way.
6. When a boat acquires right-of-way or changes course, she shall initially give other boats room to keep clear.
7. After the starting signal, a leeward boat shall not sail above close hauled if her bow is behind the windward boat's bow.
8. At marks (other than start marks) and obstructions, when an inside boat's bow is closer to the mark or obstruction than the outside boat's stern, the outside boat shall give room. This rule takes precedent over rules 1 through 4.
9. If a boat uses rules 1 through 4 to force the give-way boat to pass on the wrong side of a mark or to a given side of an obstruction, then the right-of-way boat shall also pass on that same side of the mark or obstruction.
10. If a boat knowingly breaks a rule or decides she may have broken a rule by another boat hailing "protest", then the boat may exonerate herself by performing two turns (i.e. two tacks and two jibes). There is no penalty for hitting a mark.