

Rules of SOLAR SPLASH® 2024

**World Championship of
Collegiate Solar Boating**

Revised Edition: November 2023

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Thursday

7:00 am Paddock area opens
 8:00 am – 8:30 am Morning meeting
 9:00 am – 11:00 am Slalom Round 1
 11:30 am – 12:30 pm.. Lunch
 1:30 pm – 3:30 pm Endurance Round 1
 9:00 pm Paddock area closes

Friday

7:00 am Paddock area opens
 8:00 am – 8:30 am Morning meeting
 9:00 am – 11:30 am Sprint Round 2
 11:30 am – 12:30 pm.. Lunch
 1:30 pm – 3:30 pm Endurance Round 2
 9:00 pm Paddock area closes

Saturday

7:00 am Paddock area opens
 8:00 am – 8:30 am Morning meeting
 9:00 am – 11:00 am Slalom Round 2
 11:00 am – noon Lunch
 12:30 pm – 1:30 pm Sprint Round 3
 2:00 pm Awards Ceremony

17. Schedule of Events

Slalom, Sprint, and Endurance competition days and times may be changed because of weather conditions or other reasons.

Tuesday

8:00 am – noon Registration,
Mechanical and electrical inspections
Noon – 1:00 pm Lunch
1:00 pm – 5:30 pm Mechanical and electrical inspections
6:00 pm – 7:00 pm Welcome banquet (on site)
9:00 pm Paddock area closes

Wednesday

7:00 am Paddock area opens
8:00 am – 8:30 am Morning meeting
8:30 am – noon Mechanical and electrical re-inspections (if needed),
On-the-water inspections,
Free time on water (inspections must be completed),
Design award judging
Noon – 1:00 pm Lunch
Noon – 5:00 pm Design award judging
Noon – 2:30 pm Free time on water (inspections must be completed)
3:00 pm – 5:00 pm Sprint Round 1
9:00 pm Paddock area closes

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14. Launching Procedures

At the times announced during the Event, teams will move their boats into the Restricted Area. Propellers may be attached once the boat is in the Restricted Area. Safety equipment will be checked.

Boats must be removed from the water if extensive repair work is required. Only minor repairs will be allowed on the water and must be done outside the course area. Boats left in the water must be reinspected before they compete in the next event.

At no time during the competition will a swimmer be allowed in the water to assist a boat. Wading is permitted only at the Launching Site – close-toed shoes are required (no sandals).

15. Paddock Area

This is the area that is under large tents, where each entry will have an area of approximately 400 square feet, which will include two 8' folding tables and an electrical hookup. This area may have to be adjusted, depending on the number of participants. The area is used to work on and store the boat. Participants are encouraged to have school banners or other identification. The area immediately outside the tent may be used for recharging.

Security is provided from 7 p.m. to 7 a.m. nightly during the Event. Personal valuables should not be left at the site overnight. Additionally, each team should secure their area before leaving each day in case of inclement weather.

16. Free Time on the Water

Boats that have passed all inspections will be permitted on the lake on Wednesday. The number of boats allowed on the lake at one time may be limited to ensure safety. Time limits and other details will be announced at the event in the Morning Meetings.

12. Advertising, Promotion, and Publicity

All advertising, sales promotion, and publicity material produced by the teams or their sponsors concerning or referring to the Event shall refer to the Event as “**SOLAR SPLASH 2024**”. By entering the Event, all teams shall agree to the use, without compensation, of their names and photographs in any publicity material that may be issued by the Event’s Sponsor, the Director, and their associated companies.

13. Prizes and Awards

The Sponsor and Director of the Event will recognize all teams’ participation. In addition, the following awards will be presented:

13.1 Overall and Runner-up Awards - For each event, an award will be presented to the team that demonstrates the best performance. Runner-up awards may also be presented. An Overall Winner will be determined by a formula that includes: Technical Report, Video Presentation, Workmanship, Slalom, Sprint, and Endurance. Runner-up awards may also be presented.

13.2 Innovation and Design Awards - Various engineering aspects of the boats are reviewed by panels of judges, and the boats judged to be the best in each area receive an engineering design award. These awards do not count toward scoring in the Event. More information about Innovation and Design Awards can be found at www.solarsplash.com.

13.3 Awards Ceremony - An awards ceremony will be held on Saturday following the day’s competitions. Some awards may be presented at various times during the Event.

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1. Purpose of the SOLAR SPLASH

The **SOLAR SPLASH** has been established to promote interest in Science and Technology, Education, and Personal Interactive Skills. Established for collegians, it gives students an opportunity to apply theory to a practical project in a team environment. The **SOLAR SPLASH** competition is an opportunity for students to compete and showcase their accomplishments. **In order to enhance the students' experiences, the faculty advisor may advise only and may not be directly involved in design or construction. At the event, only students may engage in "hands-on" work on the boat. Faculty and other non-team members must remain "hands-off" with regard to the boat, except for assisting with launch and retrieval.** Although it is an intercollegiate competition, high school teams who demonstrate competence may be included.

2. Administration

- 2.1 Application of Rules** - The Rules shall apply to the **SOLAR SPLASH**, hereinafter referred to as the "Event". These Rules become effective immediately and supersede all previous editions. Rules and procedures are written with the safety of the participants and spectators in mind.
- 2.2 Event Dates** - The Event will be held **June 4-8, 2024**.
- 2.3 Event Administration** - The Event is organized and produced by Solar Splash, Inc., a 501(c)(3) non-profit organization. Dr. Jeffrey Morehouse, Event Director, serves as the Headquarters primary contact. He can be contacted at hq@solarsplash.com or at (803) 920-9231 from 9 am – 6 pm Eastern Time weekdays.
- 2.4 Right to Revise Rules** - The Director reserves the right to revise the Rules at any time by providing the participants notification of revisions in the form of Bulletins, revised editions of the Rules, or announcements at the Competition.

11.5 Endurance Penalties

- 11.5.1 Obstructive Boating** - Any team that operates their boat in a manner that impedes the progress of another boat or risks the safety of another boat or of their own will receive a minimum penalty of one lap per infraction or may be disqualified at the discretion of the Officials.
- 11.5.2 Striking a Buoy** - If a boat strikes a buoy, the boat must execute a 360° penalty turn on the inside of the course prior to the completion of the event.
- 11.5.3 Failure to Yield the Right-of-Way** - Any team failing to allow right-of-way when being overtaken by another boat will be penalized a minimum of 0.5 laps per infraction.
- 11.5.4 Leaving the Course** - If a boat leaves the course for any reason, it must re-enter at the same point or further back.
- 11.6 Paddling** - Using paddles or oars to power the boat during any competitive event (other than to avoid becoming a safety hazard) will result in automatic disqualification.
- 11.7 Failure to Attend Morning Meetings** - Any team that fails to be properly represented at any Morning Meeting will be penalized and must receive a briefing before they can continue to compete.
- 11.8 Conduct** - Improper conduct including, but not limited to, improper language and obscene gestures, will not be allowed. Officials may assess penalties ranging from ten (10) points to total disqualification for improper conduct.
- 11.9 Failure to Comply with the Rules** - A team's failure to comply with any Rule may result in a penalty ranging from one (1) point to total disqualification.

11. Penalties

Any team failing to comply with the Rules, as stated herein, may be penalized. Officials are required to record all instances of unsafe conduct, and penalties will be assessed as follows:

11.1 Faculty Hands-off - faculty observed working on the boat (see Rule 1) will be given a warning. Subsequent violations will result in a minimum penalty of five (5) points per infraction.

11.2 Disturbing Official Battery Markings - When batteries are inspected, they will be given official tags. These tags must not be disturbed. Competitors are allowed to use only the batteries inspected for their boat. Officials may assess penalties ranging from fifty (50) points to total disqualification.

11.3 Slalom Penalties

11.3.1 Striking a Buoy - If a boat strikes a buoy, a five (5) second penalty will be assessed.

11.3.2 Leaving the Course - If a boat leaves the course for any reason, it must re-enter at the same point or further back.

11.4 Sprint Penalties

11.4.1 Obstructive Boating - Any team that operates its boat in a manner that impedes the progress of another boat or risks the safety of another boat or of their own will receive a minimum penalty of fifty (50) points or may be disqualified at the discretion of the Officials.

11.4.2 Striking a Buoy - If a boat strikes a buoy and remains in its lane, a five (5) second penalty will be assessed.

11.4.3 Leaving the Course - If a boat leaves its lane, its run has ended and it must be shut down and may not re-enter the course or finish.

2.5 Acceptance of Rules - All persons or groups registered to participate in the Event are expected to know and accept the Rules. Participation in the Event shall constitute acceptance of them.

2.6 Rule Interpretation - Should there be a question regarding the meaning of Rules, the participating team will file their question in writing with the Director.

2.7 Sponsors - Sponsors are listed at www.solarsplash.com.

2.8 Sanctioning - The Event is sanctioned by the American Power Boat Association (APBA, www.apba.org) as a special event.

2.9 Event Officials - The Event Officials are generally known as "Red Shirts" because of their distinctive red shirts worn at the Event. The Event Officials will be instructed in and responsible for specific duties pertaining to the operation of the Event. The Event Officials shall have the authority and responsibility to ensure compliance with the Rules.

2.10 Insurance - Each participating team is required to provide proof of general liability insurance from their educational institution or written proof that, as a state institution, they are self-insured. Proof of insurance must be supplied with the Technical Report. Failure to do so will result in a **10-point penalty** applied to the Technical Report score.

2.11 Accidents - All accidents must be reported to an Event Official and the Director immediately. Failure to do so may affect a team's standing in the Event. The Director and the Sponsors assume no liability for accidents that occur as the result of poor boat design and construction, unsafe or improper boating procedures, or any form of negligence on the part of the competitors and spectators.

2.12 Withdrawals - Any team that has agreed to participate shall fulfill such obligation unless excused by the Director. Any team wishing to withdraw must notify the Director in writing. If a team wishes to withdraw at the Event, the Director must be notified as soon as possible.

3. Definitions

- 3.1 “Paddock”** - The area where participants prepare their boat and store their boat and equipment.
- 3.2 “Launching Site”** - The area immediately around the docks, in which teams are actively engaged in launching and retrieving boats.
- 3.3 “Restricted Area”** - The Restricted Area will be enclosed by a fence, and movement in and out of this area will be through a monitored gate. Entry is permitted only after an APBA waiver is signed, and wrist bands are required. The Launching Site and docks are included in this area.
- 3.4 “System Voltage”** - The voltage measured with a VOA meter between the system ground and any point in the electrical system.
- 3.5 “Source Voltage”** - The nominal value, e.g. 24 VDC or 36 VDC, output voltage of the battery pack.
- 3.6 “Dead-man’s Switch”** - Any device that cuts off power to the motor if the skipper leaves the boat.
- 3.7 “Attempt”** - Once the Starter says “GO” the event is considered to be started.
- 3.8 “Morning Meeting”** - Morning Meetings will be held each morning Wednesday through Saturday at 8 a.m., unless otherwise posted. Attendance by a skipper and the team leader is mandatory.

Sprint - 250 points. *Your Time* will be the sum of your two best Sprint times. If a competitor completes just one Sprint heat, *Your Time* will be four times the time of the completed heat. If a competitor completes no Sprint heats, they will receive zero points in the Sprint.

$$\text{Your Points} = \frac{\text{Winner's Time}}{\text{Your Time}} \times 250$$

Endurance - 400 points. The goal is to go as far as possible in two 2-hour heats. Total distance traveled will be recorded to the nearest 0.25 lap completed.

$$\text{Your Points} = \frac{\text{Your total distance (2 heats)}}{\text{Winner's total distance (2 heats)}} \times 400$$

10. Graphics

- 10.1 Boat Number Sign** - Each boat will have a boat number assigned after the final due date for entries. Each team will be provided with a base and an “L” bracket for mounting their boat number sign. The base, or a satisfactory substitute, must be mounted in a manner that will allow for non-rotating display of the sign. All participants will be provided physically similar signs. These signs may not be modified, **and the number must be clearly visible from both sides.** The sign will not be included in the dimensions of the boat.
- 10.2 Event Logo** - The Event identification and logo (part of the boat number sign) must be displayed at all times the boat is on the water. Additional sponsor decals and/or logos may be required at the discretion of the Director.
- 10.3 School Name** - School names on the boat are strongly encouraged.
- 10.4 Inappropriate Graphics** - The Director reserves the right to disapprove any graphics it deems inappropriate or offensive. The decisions of the Director are final. No graphics will be added to the boat after Technical Inspection without the Director’s approval.

Technical Report - 90 points. The report judged as the best will receive 90 points. Others will receive fewer points as judged by a panel of technical reviewers. A PDF copy or link to the report must be sent to hq@solarsplash.com by 5 p.m. EDT on **April 29, 2024**. The boat number must be displayed on the cover in a minimum 36 pt. type. The names of all students and faculty advisors involved with the project must appear on the cover. Reports will be made available for participants of future **SOLAR SPLASH** Events. Additional requirements for the technical report can be found on www.solarsplash.com.

Video Presentation - 40 points. The presentation judged as the best will receive 40 points. Others will receive fewer points as judged by a panel of reviewers. A link to your team's video must be sent to hq@solarsplash.com by 5 p.m. EDT on **May 28, 2024**. The file permissions on the video must allow for it to be downloaded by Event officials. Requirements for the video presentation can be found on www.solarsplash.com.

Workmanship - 20 points. Points awarded will be based on quality of workmanship as determined by a panel of judges.

Slalom - 200 points. *Winner's Time* is the best time of all boats in the two rounds. *Your Time* will be your best Slalom time of the two rounds. If a competitor fails their first attempt in a round, additional attempts may be allowed, time permitting. If multiple attempts are made, *Your Time* will be multiplied by the number of attempts for that round. If a competitor does not complete the Slalom, they will receive no points for the event.

$$\text{Your Points} = \frac{\text{Winner's Time}}{\text{Your Time}} \times 200$$

4. Registration

4.1 Registration - All persons participating or officiating at the Event must register during the specified registration times. Registrants will be divided into the following categories:

- A. Participants (Students and Faculty)
- B. Officials
- C. Volunteers
- D. Sponsors and VIPs
- E. Visitors

4.2 Badging - All Registrants will be badged by category when they register to make them easily identifiable at the Event. Badges will be issued after all necessary waivers have been signed, signifying eligibility to participate in the Event. Badges must be worn at all times during the Event.

4.3 Point of Contact - One person, preferably the Faculty Advisor, must be designated as the primary point of contact for the team during the Event.

4.4 Visitors - Visitors are welcome, but may not be team members for insurance purposes.

4.5 Ballast - The official skipper weight for the competitive events shall be 70 kg. (154 lb.) Each skipper will be weighed when he or she registers. If a skipper's weight is less than 70 kg., ballast will be added to make up the difference. If the weight of the skipper is over 70 kg., no ballast will be required. Skipper and ballast will be identified with unique tags. The ballast corresponding to the skipper must be carried in the boat when it is on the water.

4.6 Release of Liability and Image Release - During Registration, everyone involved with the Event – as listed in Rule 4.1 – is required to sign this release.

4.7 Waiver for Skippers - All participants that will be on the water in a boat must be APBA members. APBA membership application will be completed at the Event. The cost is \$25. **Team members who register as skippers must acknowledge the inherent risk associated with being on the water and attest to their ability to swim.**

4.8 Waiver for Minors - Anyone under the age of 18 is required to have this waiver signed and notarized by a parent or guardian in advance of the Event.

5. Entries

5.1 Team Eligibility - Any 2-year or 4-year college, university, vocational school, or high school is eligible to compete. Entries by individuals or a club not formally affiliated with a school are not permitted.

5.2 Team Member Eligibility - Anyone who has attended the participating educational institution as a full time student in one of the past two semesters or two of the past four quarters, or part-time for the past year, is eligible to serve as a team member.

5.3 Skipper Eligibility - The skipper must be a team member and at least 14 years old.

5.4 Entry Forms - Entry forms, available on the website, must be filled out and signed by a team leader, faculty advisor, and Dean or Principal. The completed form should be scanned and emailed to hq@solarsplash.com. Each participating institution will be limited to two entries.

5.5 Entry Fees - Entry forms sent on or before **January 16, 2024**, qualify for a reduced entry fee of \$900, which must be paid no later than **February 29, 2024**. Entry forms sent after **January 16, 2024**, will pay the full \$1200 entry fee, which is due when the entry form is submitted, and must be sent no later than **April 15, 2024**.

Instructions for payment of the entry fee are found on the entry form.

9.5.1 Seeding - First-round Sprints consist of two-boat heats, **which will be filled by a random draw prior to the first round**. Second-round Sprints consist of three-boat heats, which will include a fast, medium, and slower boat based on first round results. The three boats with the fastest times in the first two rounds advance to the Championship Heat. Prior to the Championship Heat, all other boats also run a third time, grouped from slowest to fastest.

9.6 Endurance - The Endurance event will be held over a closed course not exceeding 2 km in length. There will be two 2-hour heats, with all boats starting at the same time.

9.6.1 Overtaking - Once an overtaking boat establishes overlap (the bow breaks an imaginary perpendicular plane across the stern of the overtaken boat), the overtaken boat must maintain its expected course and not impede the overtaking boat.

9.6.2 Turning at Buoys - The first craft to reach within two boat lengths of a buoy has the right-of-way until the stern of the craft has cleared the buoy. The second craft has the responsibility of not obstructing the first craft.

9.7 Support Boats - No support boats will be allowed.

9.8 Reporting of Results - The results of each day's events will be available no later than the following day's Morning Meeting. The results of the final day's events will be announced and posted at the final awards ceremony.

9.9 Overall Scoring - The Overall World Champion will be determined by a 1000-point scoring system as follows:

Technical Report	90 points
Video Presentation	40 points
Workmanship	20 points
Slalom	200 points
Sprint	250 points
Endurance	400 points

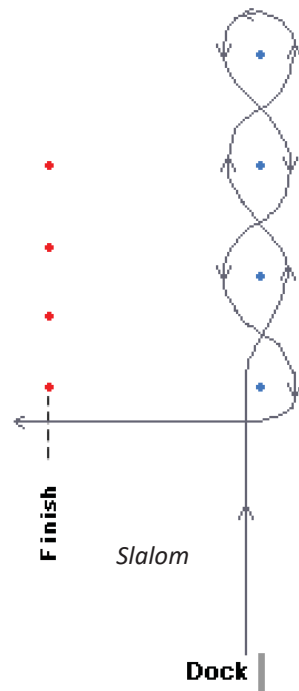
- 8.2 Configuration** - The boat will be operated by a skipper at all times. No remote control or autonomous operation is permitted.

No components may be removed from or added to the boat for different events. However, the boat configuration may be modified by replacing or exchanging individual components (motors, propellers, drive train components, rudders, etc). All components that will be used in any of the events must be safely secured within the boat for all events.

All components used in any event must be inspected along with the boat. Inspections may be performed at any time at the discretion of the Inspectors.

9. Competition Events

- 9.1 On-the-water Events** - The on-the-water events fall into competition categories as described below (courses may be as shown or mirror-image). Boats are required to get to the start line and return to the Launching Site by motoring or paddling unless towing is required for safety.
- 9.2 Start and Finish** - All on-the-water events will commence from a standing start. Each event's finish is indicated by the bow crossing the appropriate mark.
- 9.3 Competition Events** - Results from the Slalom, Sprint, and Endurance events will be used in determining points towards each team's total score.
- 9.4 Slalom** - The Slalom event will be run in the manner shown. The spacing of the Slalom buoys is approximately 25 meters.
- 9.5 Sprint** - The Sprint event will be held over a 300-meter straight course.



6. Venue

The site for **SOLAR SPLASH 2024** is Champions Park Lake at the Clark County Fairgrounds in Springfield, Ohio. Site pictures can be seen on www.solarsplash.com.

7. Regulations

7.1 Technical Specifications

- 7.1.1 Length** - The overall length of the boat may not exceed 6 meters (19 ft, 8 in). This does not include the boat number sign.
- 7.1.2 Width** - The maximum allowable width, including the solar array, is 2.4 meters (7 ft, 10.5 in).
- 7.1.3 Height** - The maximum allowable height above the waterline is 1.5 meters (4 ft, 11 in). This height can never be exceeded during the events. This does not include the boat number sign.
- 7.1.4 Depth** - No restriction. An excessive depth may make the boat awkward to handle near shore and may increase the likelihood of encountering underwater obstacles.
- 7.1.5 Cross Sectional Area** - In profile, the fixed area (such as the hull) is unrestricted. The solar array may be fixed or may be in the form of one or more movable panels.
- 7.2 Materials** - Teams are encouraged to be creative in the selection of materials. The only restrictions are 1) flexible materials are not allowed to create a sail, 2) any materials that would pollute the water are not allowed.
- 7.3 Power** - Sunlight is the only power source that shall be used for charging and propulsion. Wind and human power are not allowed. The sunlight may be direct (received onboard during the Event using solar arrays) or may be stored in batteries or in other approved energy storage devices.

- 7.3.1** Batteries - Boats are allowed to carry 45.5 kg (100 lb) of lead-acid batteries in all events. **One set of batteries will be inspected and permitted for use in the competition.** Batteries can be charged only from the inspected solar arrays during the Event. Batteries may be brought to the Event fully charged.
- 7.3.2** Solar Array - Entries are permitted to have **720 Watts** under normal one sun conditions. A minimum of **360 Watts of solar power under one sun conditions must be carried on the boat in all events.** **The onboard solar configuration must remain the same for all events.** Commercially-built solar panels will be verified for compliance by using the manufacturer's specifications. Student-built solar panels will be verified for compliance by using the individual cell specifications, which must be provided at Inspection. A power allowance of 10% will be given to student-built panels, i.e. the total power of the individual cells can add up to 792 Watts.
- 7.3.3** Supplemental Batteries - The bilge pump and skipper's radio must be powered by supplemental batteries. Measurement and telemetry devices may also be powered by supplemental batteries. Any other devices requiring electric power must use the energy storage as defined in Rule 7.3.1. The supplemental batteries are not limited to lead-acid technology, and the bilge pump battery must be securely fastened to the hull. Supplemental batteries may be charged from sources other than the inspected solar arrays.
- 7.3.4** "System Voltage" - May not exceed 52 VDC or AC RMS.
- 7.3.5** "Source Voltage" - May not exceed 36 VDC nominal value (usually 3 batteries). A maximum open circuit voltage of 52 VDC for the photovoltaic charging devices is allowed.
- 7.3.6** Energy Storage Devices - In addition to the storage of solar energy in batteries, energy may be stored using other devices such as capacitors or flywheels. Storage of energy may begin upon entering the Restricted Area.
- 7.4 Visibility** - The skipper must have unobstructed vision forward and at least 100° to either side.

- 7.13.10** Covers and Shields - The boat's revolving parts must be suitably covered to prevent accidental contact. All steering linkage must be shielded from contact with the skipper. If a flywheel is used, an NHRA approved scatter shield must cover it.
- 7.14 Propeller Safety** - The propeller may not be attached to the shaft except when the boat is in the Restricted Area or on the water. The motor electrical system must be deactivated using the Dead-man's Switch and the Motor Switch prior to installing or removing the propeller. The motor may not be run with the propeller attached when the boat is on land.
- 7.15 Boat Impound** - Once a boat is brought to the competition site, it must remain on site throughout the competition.

8. Inspections

Boats will be inspected to verify compliance with the Rules. **Boats must undergo mechanical and electrical inspections by Tuesday at 5:30 pm. Boats that do not pass inspection on Tuesday will be re-inspected on Wednesday.** A boat must pass both mechanical and electrical inspections prior to proceeding to an on-the-water inspection. **All inspections (mechanical, electrical, and on-the-water) must be completed by Wednesday at noon to be eligible to compete in the Event.**

Each team will have a copy of its Technical Report available at Inspection time. Any changes made after Inspection require re-inspection.

- 8.1 Safety** - Each team is responsible for the seaworthiness of their boat. Passing Technical Inspections does not relieve the team of any liability. All boats must be maintained in a safe, seaworthy condition at all times.

- 7.13.4** Buoyancy - Sufficient flotation must be provided on board so that the boat cannot sink, even when filled with water. A 20% safety factor must be included in the calculations. Verification calculations must be included in the Technical Report. Failure to do so will result in a **5-point penalty** applied to the Technical Report score. Revised calculations must be presented at Inspection if significant changes have been made since submission of the Technical Report.
- 7.13.5** Towing - A fitting for emergency towing must be attached at the bow. Its hole diameter must be at least 14 mm (0.56 in). All boats must carry a minimum of 5 meters of towing line, which will be provided at Registration. The towing line must be attached to the fitting and must be made easily accessible for emergency towing.
- 7.13.6** Signal Devices - Two signal devices must be carried on board the boat at all times. They are:
- A. Audible - a sound-producing device (a pressurized air can is acceptable).
 - B. Visual - an orange ("skier in the water") warning flag. This flag must be displayed in the event of a breakdown. A socket for the flag must be provided to allow the skipper to paddle the boat.
- 7.13.7** Paddle - A paddle, no less than 60 cm (23.6 in) long with a blade at least 13 cm (5.1 in) wide, must be on board at all times. The skipper will be required to propel the boat with the paddle during Technical Inspections.
- 7.13.8** Fire Extinguisher - A U.S. Coast Guard approved fire extinguisher with a minimum capacity of one pound must be carried on board.
- 7.13.9** Automatic Bilge Pump - an automatic electric bilge pump that is powered by a supplemental battery is required. The pump must have a minimum rating of 360 GPH. The discharge hose may not be smaller than the outlet on the pump. The hose must be secured to the hull to ensure that the discharge goes overboard.

- 7.5 Stability** - The stability of the boat will be tested by placing 10 kg at the sheer line (outer edge at the beam) with the skipper stationary in the normal operating position. The boat must not heel more than 15°. Skipper must remain centered with hands/feet in normal position.
- 7.6 Dead-man's Switch** - The dead-man's switch must be functional at all times when the skipper is in the boat and must be demonstrated in an egress test during Technical Inspection.
- 7.7 Circulation** - Fresh air must be provided for the skipper if the cockpit is enclosed.
- 7.8 Ballast** - The ballast must be placed in a manner such that the ballast will fall out of the boat if it capsizes (turns over 180°), or adequate flotation must be provided for the ballast.
- 7.9 Electrical**
- 7.9.1** Shock Hazards - All exposed conductors operating at greater than thirty-six (36) volts must be properly insulated.
- 7.9.2** Battery Type - Only lead-acid rechargeable batteries are permitted. Fuel cells, primary batteries, or mechanically rechargeable batteries will not be approved. Each team is responsible for supplying their own batteries. The batteries must be commercially available, lead-acid, unmodified with their weight consistent with the Rules. Batteries must be unmodified stock (as manufactured) in every sense. The battery modules may not be modified in any manner, including the addition of electrolyte additives, case modification; or plate addition, removal, or modification. Manufacturer's specifications, plus MSDS sheets, must be supplied with the Technical Report. Failure to do so for the batteries you plan to use will result in a **10-point penalty** applied to the Technical Report score.

If you do not supply literature in the Report, you will be penalized, your batteries will be weighed on site, and no tolerance beyond the prescribed weight will be allowed. If you decide to use batteries different from those in your Technical Report, you may do so with no penalty by bringing the new batteries and Manufacturer's specifications, plus MSDS sheets, to Inspection on site.

- 7.9.3 Battery Safety** - Batteries must be enclosed in one or more battery boxes or a portion of the hull to separate them from the skipper. Battery containment shall not be sealed and must allow for ventilation. Battery containment must protect the skipper from battery explosion and leakage, and may be plastic, fiberglass, or similar materials that will not chemically react rapidly to battery acid. All electrical cables must be properly sized to expected system currents.
- 7.9.4 Motor Switch** - The boat must have a switch wired to disconnect all power to the motor. The device must be able to interrupt full load current. It must be clearly marked in 10 mm high letters as the "Motor Switch" and be plainly marked with "ON" and "OFF" positions in 10 mm high letters. A relay may be used for the switch function.
- 7.9.5 Main Fuse** - A separate fuse (not a circuit breaker) must be in series with the main battery and the rating must be such that it protects the boat's wiring.
- 7.10 Radios** - During all events radio communication between the skipper and a team member on shore is required. There is no restriction on the type or frequency of voice or telemetry radio communication. Radios will be checked during Technical Inspection, and channels will be assigned. A team member must be in an area designated by the Director with a radio any time their boat is on the water.
- 7.11 Skipper Cockpit Egress** - The skipper's cockpit must provide for the skipper's unassisted exit within 5 seconds in case of emergency. The five (5) second exit, as well as the function of the dead-man's switch, will be checked during Technical Inspections.

- 7.11.1 Harnesses** - No harnesses or restraints to hold the skipper in place will be allowed.
- 7.11.2 Safety** - The cockpit area will be inspected for hazards and compliance with the Rules during the Technical Inspections and in the Restricted Area.

7.12 Fasteners

- 7.12.1 Steering System** - All fasteners associated with the boat's steering system must be equipped with locking nuts, double nuts, or nuts secured with safety wire or cotter pins. Loctite® may be used in areas of difficult accessibility.
- 7.12.2 Batteries** - Batteries must be secured to the hull. This must be done with a strap not less than 1¼" in width, or other hold-down device, that will not allow the battery to come loose if the boat capsizes. Velcro is not acceptable.
- 7.12.3 Solar Panels** - Each panel, with or without a frame, must be attached with a mechanical fastening to the hull. The design should take into account the possibility of gusty winds during the events. In addition, a lanyard must be attached from each solar panel to a secure member of the hull or a frame that attaches to the hull. The lanyard must be strong enough that it will not break if the panel should go into the water while the boat is moving.

7.13 Safety Equipment

- 7.13.1 Life Preservers** - A life preserver, USCG approved Type I, II, or III, must be worn by all skippers and safety boat occupants at all times. **It will be checked for proper fit.**
- 7.13.2 Safety Glasses** - Protective eyewear must be worn at all times by anyone who is handling batteries or operating power tools.
- 7.13.3 Shoes** - Close-toed shoes are required for all participants while working on a boat and while in the Restricted Area.