



Photovore Exhibition

Objective:

Extracting all their energy from the environment, solar powered robots compete for space and light. As a display event, the Photovore Exhibition will start at the beginning of the games and run through out the day's events.

Participants can drop off their Photovores in the morning and attend other events, or stay and watch the show. ECRG will award prizes for the best competition Photovores. In addition, all participants will receive a time-lapsed video of the event.

Spectators are sure to enjoy the action as robots scurry to and from the light pools.

Competitor Design Parameters: Photovore

These rules serve as guidelines only. The judges have the right to clarify, augment, or modify these rules for the good of the competition and to promote fairness. As always, the judges' decisions will be considered final.

Size. At the start of the competition, the Photovore must fit within a 10 cm (3.93") cube. The robot can change its size during the competition. It cannot, however, discard any part of itself. The robot must complete the competition with the parts that it had at the beginning.

Weight. This competition does not place any restrictions on weight.

Identification. The Photovore must have a mounting or flagpole for a 2cm by 3cm paper flag. Ideal flagpoles include a paper clip or small brass rod sticking vertically off the robot. The judge will provide and attach the flag to the Photovore before placing the robot in the arena. This flag will be made of colored paper and be as light weight as possible. If the participant is competing with a team or swarm, this rule will apply to the flag bearer only.

Power source. Solar is the only allowed power source. The only limit to the size and shape of the solar panels is the Photovore size restriction mentioned above. Participants must replace any solar cell that is in violation of this rule.

Power storage. The Photovore may immediately use the solar power, store the power in storage capacitors (Aerogel, Electrolytic, etc.), or convert the solar power into mechanical energy (springs). The robot may not use batteries

Shorting Switch or Circuit. Photovores will enter the exhibition without stored electrical power. The robot requires a switch or button that, when pressed, will short out the storage capacitors and leave the robot in a 0-Volt state.

Fitness. During the competition, Photovores will spend much of the time butting heads with each other. It is important that participants design and build their robots for these conditions. We recommend that bump sensors or shell sensors (such as on Gray Walter's Machina speculatrix) be used instead of spring tactile sensors. The standard Beam tactile sensors tend to hook onto other robots. Likewise, all wiring should be secured or tied down. While no minimum requirement is set on engineering principles, the Photovore must be fit enough to complete the event intact.

Non-destructive. Judges will disqualify the Photovore if it has parts that could damage the Flatlands arena or other robots. Any robot that displays destructive behavior during the event will be removed. The robot may touch objects within the arena for navigation and may use traditional sumo techniques to push the opponents out of the goal areas.

Teams and Swarms:

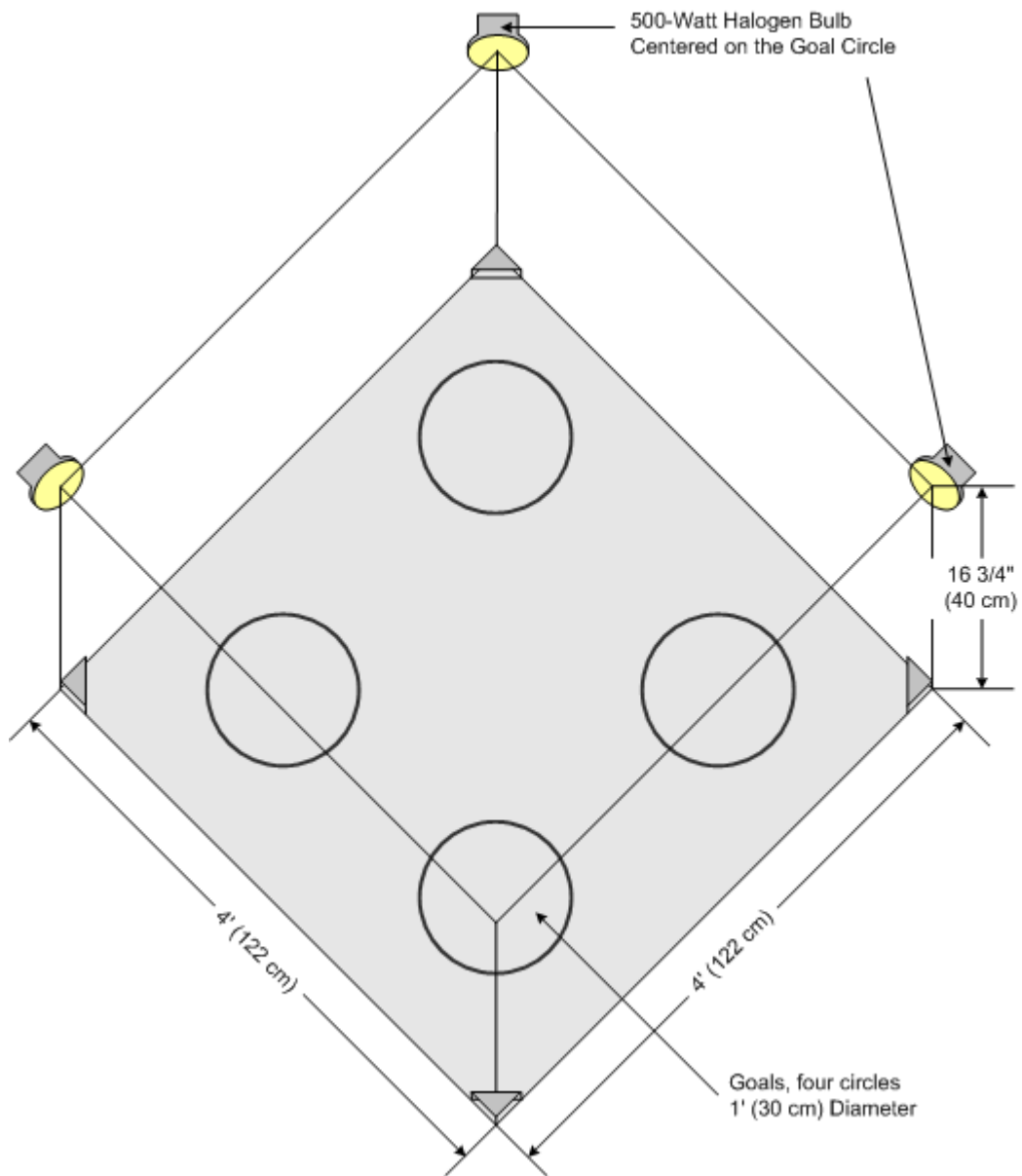
Participants may elect to enter a team or swarm of Photovores. For the purposes of this event, a swarm is comprised of two to four individual Photovore robots. Each individual must qualify under the Competitor Design Parameters: Photovore section. Swarms may communicate over any channel (IR, RF, audio, etc.) providing that the communication channel is allowed within the building hosting the event.

Participants that enter a swarm must elect one robot to be the flag bearer. This robot will be used for scoring purposes. The robot that is the flag bearer will remain the flag bearer through out the event. If this robot becomes disabled, then the entire swarm is effectively disabled.

Individual robots from different participants cannot communicate and act as a team. If they do, then these Photovores will be judged as a swarm for the purposes of this event. This section will limit the total number of robots from both participants. Only one robot will be the flag bearer and thus be eligible for scoring points.

Exhibition Platform: The Flatlands

The purpose of the Photovore Exhibition is to provide participants with a way to see their creations interact on a wide scale and provide spectators with an interesting and lively display. The Flatlands arena is a key part in achieving this aim. It must present an attractive, well-lit surface for the Photovores to roam. It should be placed near an intersection or other high traffic area in order to maximize spectator attention.



The Flatlands arena is a 4' (122cm) square enclosure. The arena will be as smooth as possible to allow the Photovores free roam. The flooring is white or light beige to avoid heat buildup. The walls are flat black to avoid attracting the Photovores.

There are 10cm wedges in the corners. Meant to keep Photovores from becoming stuck in a corner, the wedges are painted flat black or similar dark color to aid the robots in detecting and avoiding them. These may be made of wood or foam.

There are two or more obstacles placed on the Flatlands arena. These are positioned to interrupt the direct path from one light source to the next. The obstacles split the Photovores up and keep them from tangling in the middle of the arena. These may be islands made from arborite or round poles. All obstacles are painted flat black or another dark color.

8 cm or 3" is the minimum height for walls, wedges, and obstacles.

There are four goal circles on the Flatlands. One goal is in each of the four quadrants. The circle is 30cm in diameter. The line marking this goal is black and approximately 1cm thick.



Illuminating the goal circles are four halogen lamps. ECRG 2005 utilized Regent Lighting halogen work light (Model# PQS45); however the actual lamp may vary. These are placed on the corners of the arena at a height of 40cm and focused on the circle centers. As the effective angle of lighting is 45-degrees, it is recommended that Photovores use a combination of light-seeking and line detecting to locate the goal.

The video camera is positioned above the arena in order to record the exhibition. Beside the camera, additional lamps may be mounted to provide ambient lighting. Such lighting will be equally balanced so as to minimize any confusion on the part of the robots.

Exhibition Procedure:

Pre-exhibition testing. Prior to the event, participants will have one or more opportunities for testing and calibrating their robots in the Flatlands arena. Given the flow of the Games, the opportunity for testing may be on a different day than the event and may be on a different (but similarly constructed) racing platform. Participants should check the ECRG schedule of events for testing times.

Exhibition check-in. The participants bring their robots to the judge. The judge inspects the robots, making sure that they meet the rules set forth in this document. If any robot does not meet the requirements, it will be disqualified. The judge will attach colored 2cm by 3cm paper flags to the qualified robots' flagpoles.

Exhibition startup. The judge will drain or short the Photovore storage capacitor, thus ensuring it starts without stored electrical power. The judge then places the robots into the arena. He or she will place the robot within a random goal circle, taking care to evenly spread the robots around the arena.

Before the event starts, the Flatlands arena will be fully lit from all four halogen lamps. Participants will have a set amount of time to get their robots to the judges. Thirty minutes is recommended for this pre-match period, but the judges will determine the actual time.

Number of Photovores and House Bots. Twelve Photovores are considered a full house, although the competition can support a larger number. If there are less than twelve qualified robots, the judges may add house bots to the arena. These house bots will compete on equal footing as the other Photovores, and must meet the requirements in the Competitor Design Parameters: Photovore section. However, house bots will not be eligible for points.

Running the Exhibition. After concluding the startup period, the judge will start recording video and begin the random lighting. Only one Halogen lamp will be lit. The goal circle under this lamp then becomes the active goal, and the Photovore robots will move to that goal. Because the robots start the competition at different goal circles, some of the robots will automatically be within the first goal circle. Therefore, the first lit goal circle is considered the starting point. No points will be awarded for this first light shift.

Through out the exhibit, only one lamp will be lit at any given time. Light shifts will occur at periods of five minutes. The currently lit Halogen lamp will turn off. Another lamp will be chosen at random from the remaining three. The new lamp will turn on and remain lit until the next light shift.

The judges will determine the competition's runtime. In general, the competition will begin in the morning and run until the day's other events have ended. This may be anywhere from five to eight hours in duration. Depending upon the number of participants, the judges may decide to run two or more competitions through out the course of the day. During this time, the participants are free to attend other events or presentations.

At the end of the event, the judges will signal to the Photovores by turning off the lights. The judges will stop the video camera. Finally, they will remove and return the Photovores to the participants.

Scoring Method:

The judges will use the sped-up video to determine point scoring. Points will be awarded as follows:

Speed point. The first set of Photovores to the goal circle will receive one point. The number in the set is one-third of the total number of competitors, rounded to the nearest whole number. For instance, the set for twelve Photovores would be three, six Photovores be two, and so on.

Stamina point. All Photovores remaining within the goal circle when the light shifts will receive one point. The stamina point goes to the Photovores have made it to the circle and either stayed within the circle or returned to the circle after being pushed out.

In order to win either the speed or the stamina point, the Photovore must have its flag within the goal circle. In addition, the Photovore must seek out new light sources. Robots that stay in a single goal circle (“goal hugging”) will not be awarded the points. If the participant has entered a team, then this caveat applies only to the flag bearer (see the Teams and Swarms section).

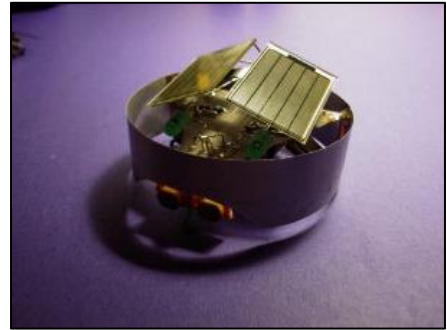
Winning score. The winning score is twenty points. First place goes to the first Photovore to reach twenty, second place goes to the second Photovore, and so on. In the event that the robots do not reach twenty, the judges will use the point standing to determine the first, second, and third placed robots.

Competitive Strategies:

There are many ways to win at the Photovore Exhibition. Listed below are a few possible strategies. With any luck, one of them will inspire you.

Speed racers. With one point being available to only the first few robots that make it to the light, the most obvious strategy is to build light, fast robots. Solder two solarrollers together and away you go. Remember to watch and avoid obstacles within the Flatlands, and other robots.

Tanks. Other robots are definitely a hazard to your Photovore, so build accordingly. Make sure that your robot has a low center of gravity and does not tip easily. Also, you might consider giving your robot some light-weight armor or shielding. This is what Scott Martin did with his Attack-Mosher (left).



Sumos. Regarding the stamina point, wherein the Photovore is rewarded for staying in the light, consider using a sumo strategy. Micro-sumo and Nano-sumo robots are eligible to compete providing that they replace their battery packs with solar engines (solar cells and capacitors). One could consider the goal circles as miniature sumo rings.

Bodyguards. The Teams and Swarms section opens up the possibility of combining strategies. For instance, have the flag bearer be a fast, lightweight Photovore. First in the ring gets the bot the speed point. Then, have a team of up to three sumo-styled robots act as the flag bearer's bodyguards. Last in the ring wins the stamina point.

Scouts. The opposite of the bodyguards, the scout strategy is where several small robots race out and scout the goal circles for the brightest light. These report to the heavier and stronger flag bearer, who then heads for the goal circle. If done properly, the flag bearer is able to expend less energy on finding the goal, and more energy defending it.

These are just some of the many strategies useful for winning in the Photovore Exhibition. We hope to see you there!

Acknowledgements:

The Photovore Exhibition was directly inspired by the BEAM Photovore Competition rules. The Flatlands arena derives its form from a combination of these rules and a post by Mark W. Tilden on constructing robot parks. Special thanks to the Yahoo! BEAM Group for providing the insightful criticism that shaped this document.

1. Mark W. Tilden, "[alt-beam] Re: On making a better RJP...", 14 Feb 2000

<http://groups.yahoo.com/group/alt-beam/message/10211>

2. Eastern Canadian Robot Games 2003, Photovore Rules

<http://www.robotgames.ca/rules/Photovore2003.pdf>

3. Yahoo! Groups: BEAM Robotics

<http://groups.yahoo.com/group/beam/>