

Senior Design Competition

Thank you to our judges:

**Introduction**

**Context**

In a context where it is not justifiable to use fossil fuels for transportation uses, and where conventional batteries are increasingly challenged, we are asking several teams of different Quebec universities to explore new solutions for energizing our vehicles.

**Objective**

The teams will have to design and build a small car that will have the ability to move on a straight path with two obstacles, being a sand trap and a slope. The goal is to reach the end of the course in the least amount of time possible and to never deviate from the path (if the vehicle falls, the test is over and a penalty will be applied, see scoring). The vehicle must be autonomous and be able to stop in the finishing zone.

**Conditions**

**Restrictions**

The vehicle must be less than or equal to the following dimensions: 6” x 6” x 10”. Disregarding these limits will result in disqualification of the designed machine and only points for the presentation will be awarded. Everything must be interdependent and it is not allowed to “lose” pieces. At the end of the run, the entire vehicle must be within the arrival zone to obtain full points. When measuring the distance travelled, the part closest to the starting line will be taken into consideration.

**Preparation**

Before running a test, the team has 60 seconds using a maximum of 2 people to “prepare” the vehicle. Preparation can include loading capacitors through an external source, moving mobile parts to starting position (springs), etc.

**Starting**

Starting the vehicle must be done using a simple action. A simple action is defined as an action conducted by a single person, with one hand in less than 0.5 seconds.

**Execution**

The vehicle must be autonomous. After starting, the vehicle must travel the entire distance of the course without exterior interference. It must also stop in the finishing zone without deviating from the course (see evaluation)

**General Constraints**

**Team**

Each team can be composed of maximum of 4 undergraduate students in engineering, each having completed 60 or more credits of their major program.

**Duration**

Teams will have 4 hours before final tests to conceptualize/build their vehicle and prepare a 10 minutes presentation explaining their concept.

**Course**

The playing field is provided as-is and students are responsible for taking measurements. During the first hour of the event the course will be fully accessible to everyone, but afterwards it will only be available for measurements and/or testing by appointment. Each course access session will be exactly 5 minutes long and must be booked ahead of time. All teams are limited to 3 testing sessions throughout the day.

**Equipment List**

**Material**

* 12” x 12” ISOLOFOAM
* 12” x 12” OSB Panel
* 1 Perforated Prototyping Plate
* 1 Breadboard
* 25 ft Wire connection
* 2 Small gear motor
* 2 Limit switch
* 2 Infrared proximity sensor
* 1 Gear set
* 1 Arduino Uno
* 1 9V battery
* Power supply cable
* USB Cable
* 20 Resistances from 0.125 to 0.250 Watts
* 1 50F capacitor
* 5 Capacitors, inferior to 1mF, inferior to 16V
* 1 H bridge (L293D L298 or L298E or other)
* 1 Voltage Booster (Hacheur-élévateur) 5V or a second 50F capacitator
* 4 Diode Zener 3,3 V
* 4 Diode Zener 5,0 V
* 8 Diode 1N4001 (or equivalent)
* 4 Transistor 2N3904 (or equivalent)
* 4 Transistor 2N3906 (or equivalent)
* 1 Cyanoacrylate glue tube
* 100 Different elastics
* 100 nails
* 50 Popsicle sticks
* 5 Metal hanger

**Tools**

**No tools can be part of the vehicle.**

**Evaluation**

The evaluation is done in two steps, first each team will present its prototype, and then each will test it on the course.

Each team has two tries on the course.

The order of teams will be determined randomly before each stage of the evaluation.

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| --- | --- |
| Evaluation Criteria | Weight |
| Presentation  | **/25%**  |
| Quality of presentation  | 5%  |
| Design process  | 5%  |
| Considered concepts  | 10%  |
| Robot design (aesthetics)  | 5%  |
| Course  | **/75%**  |
| Distance travelled (1% per 8''- max 40%)  | 40%  |
| Successful sand trap  | 10%  |
| Successful slope  | 10%  |
| Finishing area respected  | 15%  |
| Fastest team to get to the finish shin zone  | Bonus 10%  |
| Total  | **100%** |

Precision on evaluation

**In case of sinking in the sand trap**

The team will be allowed to remove the vehicle from the sand trap, but they will lose all points related to the obstacle and will be given a 50” penalty.

**Deviation**

The vehicle is considered to have deviated from the course if it touches the ground or falls. In case this happens, the distanced travelled is calculated between the last point touched by the vehicle on the course and the departure point. A 40” penalty is applied in this case, or a 120” penalty is applied if the vehicle has reached/touched the arrival zone before deviating

**Questions**

For all questions on the challenge and competition, participants should refer to the organizers following the given protocol. It is the responsibility of the organizers to make all questions and answers available to all participants.

**Rule Adjustments**

Inevitably this rule document will prove to be incomplete. Participants are encouraged to point out ambiguities and inconsistencies to the organizers, as we will promptly evaluate the situation and update the rules accordingly. Any such on-the-fly rule updates will be written down on a central message board and announced to everyone, such that all teams are kept informed, as is only fair. Situations may also arise where the rules are very clear and unambiguous, but team members notice ways of circumventing the intended spirit of the competition. In such cases, you are encouraged to make full use of your creativity in exploiting such loopholes and technicalities.