

# **SHELL ECO-MARATHON**

2022 AUTONOMOUS URBAN  
CONCEPT COMPETITION RULES  
CHAPTER IV





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## **1. KEY TERMS**

The Shell Eco-marathon Autonomous Urban Concept Competition 2022 will take place during Shell Eco-marathon France II 2022 from July 3 - July 6, 2022, at the Circuit Paul Armagnac, Nogaro in France. Both competitions are organised by Shell International Limited (which is incorporated and registered in England with company number 3075807, address: Shell Centre, York Road, London, SE1 7NA, UK).

Where terms have already been defined in the [Shell Eco-marathon 2022 Official Rules, Chapter I](#), and in the [Shell Eco-marathon France II 2022 Rules, Chapter II](#), the same shall apply for the Shell Eco-marathon Autonomous Urban Concept Competition 2022 Rules, Chapter IV.

By fact of their entry, Participants accept all provisions in these Competition Rules and agree to abide by all decisions made by the Organisers. The Organisers reserve the right to add, modify or delete any Article of the Competition Rules.

All decisions made by the Organisers are final and binding.

AUC	Autonomous Urban Concept Competition
Autonomous System	The computer hardware, software and sensor system fitted to an Urban Concept car, including all power supplies, cables, and connectors
Digital map	A digital representation of the environment in which the autonomous vehicle will operate
Communications protocol	A specification of all the message types and content between two computer systems
OBC	Refers to the Shell On-Board Computer, energy sensors, antennae and necessary cables and fittings. The OBC is used separately and in parallel to any other computing systems present in the vehicle. Computer systems integrated by teams shall be referred to in this document as Internal computer systems
ICS	Vehicle Internal Computer Systems

## **2. CHAPTER I AND CHAPTER II RULES APPLY**

- a) The Shell Eco-marathon 2022 Chapter I and Chapter II Rules both apply to the Autonomous Urban Concept Competition.
  - i. The only exceptions to the Chapter I Rules are:
    - 1. External appendages are allowed for autonomous sensors.
    - 2. A reasonable vehicle weight increase is allowed for the addition of a computer and mechanical actuators.
  - ii. The only exceptions to the Chapter II Rules are:
    - 1. Section 4 - Competition/Practice
    - 2. Section 6 - Trophies, Prizes and Awards
- b) Teams must pass Technical and Safety Inspection to compete in the AUC.
- c) Additional technical scrutiny will be applied to determine that the autonomous hardware is attached securely, wired neatly, vented properly, and does not compromise the safety features of the vehicle.
- d) A specific Drivers and Team Manager daily briefing will be given, presence is mandatory.
- e) The Driver must be present in the vehicle during each challenge and ready to take control and stop the vehicle if needed.
- f) A panic button must be installed in the driver compartment. If the panic button is pressed, it must cause the autonomous system to instantaneously disengage. The panic button may be independent of the emergency stop.
- g) The Organisers may change the Chapter IV Rules at any time as the Autonomous Urban Concept Competition is currently in a development phase.

### **3. COMMUNICATION OF AUTONOMOUS STATE**

- a) Teams shall install lighting on the outside of the vehicle that is visible from all sides and indicates whether the car is being driven autonomously (by the ICS) or manually by the Driver. These lights shall be controlled by the ICS system and may not be activated or deactivated by the driver or remotely.
- b) The Driver must hold their hands up to be clearly visible through the vehicle windows during each autonomous challenge.

## **4. CHALLENGE STARTS AND FINISHES**

All AUC challenges will follow a similar process.

- a) Track sections used for these challenges will be defined with the following track markings and structures:
  - i. Start line
  - ii. Finish line
  - iii. Lines and markings on track, depending on requirements of challenge
- b) Before the start signal, vehicles will wait behind the start line.
- c) Upon the start signal, the vehicle will begin the challenge from a defined position on the track. The vehicle must be in autonomous mode before the front of the vehicle crosses the start line.
- d) Teams will have a time limit of 120 seconds from the start signal to start their attempt. If the team cannot start in this time, they must move aside to give the next team a chance to start.
- e) The timing for each challenge will begin when the vehicle crosses the start line.
- f) The challenge timing will stop when the challenge time ends, when the vehicle crosses the finish line, or when the vehicle fails to complete a key component of the challenge.
- g) Once the front of the vehicle has crossed the start line, any contact between the vehicle and track barriers or obstacles, or at least one wheel crossing a track boundary, will invalidate the attempt.

## 5. 2022 AUTONOMOUS URBAN CONCEPT CHALLENGES

The challenges for the 2022 AUC are:

1. Driving Autonomously (35 points)
2. Parking Manoeuvrability (20 points)
3. Obstacle Avoidance (20 points)
4. Business Presentation (25 points)

### CHALLENGE 1: DRIVING AUTONOMOUSLY

The goal of this challenge is for vehicles to drive autonomously over a fixed distance.

- a) Only one vehicle will attempt this challenge at a time.
- b) Teams will have a set number of attempts to complete the challenge (exact number of attempts to be announced prior to start of the competition).
- c) Any wheel crossing a track boundary, or any contact between the vehicle and the protective barriers, will result in an invalid attempt.
- d) If the autonomous state is disengaged at any point during the challenge, the attempt will be invalid.
- e) The speed limit is 25 km/h. The attempt will be invalid if the speed limit is exceeded.
- f) Teams will have a time limit of 12.5 minutes from the start of their attempt to complete their challenge.
- g) If the vehicle does not complete the challenge within the given time, the score will be based on the total distance completed.
- h) The team will receive a maximum of 35 points if they complete the challenge successfully. Judges will allocate points based on the distance completed 'truly autonomously'.

### CHALLENGE 2: PARKING MANOEUVRABILITY

The parking manoeuvrability challenge will test the ability of vehicles to approach and stop within a designated parking space without touching any barriers.

- a) The parking manoeuvrability challenge will be held on a straight length with three rectangles 3 m long and 2 m wide marked on the track, representing parking spaces. Two parking spaces will be occupied with an object (at least 50 cm high, 1 m long and 1 m wide). Vehicles must drive to and stop with all four wheels inside the only available rectangle (i.e., not occupied by an object).
- b) If a vehicle wheel stops on or outside of the lines of rectangle, the attempt will be invalid.
- c) If any part of the vehicle contacts the block or a track barrier, the attempt will be invalid.
- d) Teams will have a time limit of 90 seconds from the start of their attempt to complete the challenge.
- e) The challenge will end when the vehicle has come to a complete stop.
- f) Teams will have a set number of attempts to complete the challenge (exact number of attempts to be announced prior to start of the competition).
- g) The team will receive a maximum of 20 points if they complete the challenge successfully. Judges will allocate points based on the completion and how 'truly autonomous' the attempt was.



**CHALLENGE 3: OBSTACLE AVOIDANCE**

This challenge will demonstrate the vehicle's ability to successfully navigate around road obstacles.

- a) The obstacle avoidance challenge will happen on a length of track of between 50 m and 80 m. A set of chicanes will be arranged on the track. As an element of surprise, the exact number and positioning of the chicanes will not be revealed by the Organisers until the day of the challenge.
- b) Teams will have a time limit of 90 seconds from the start of their attempt to complete the challenge.
- c) Any contact between the vehicle and the protective barriers or chicanes will result in an invalid attempt.
- d) Teams will have a set number of attempts to complete the challenge (exact number of attempts to be announced prior to start of the competition).
- e) The team will receive a maximum of 20 points if they complete the challenge successfully. Judges will allocate points based on the completion and how 'truly autonomous' the attempt was.

**CHALLENGE 4: BUSINESS PRESENTATION**

This challenge requires teams to demonstrate their teamwork and describe the engineering processes behind their autonomous vehicle to a board of judges.

The judges will be looking for:

- i. Completion of autonomous challenges
- ii. Quality of autonomous systems
- iii. Management of financial resources
- iv. Demonstration of integrated engineering disciplines
- v. Consideration of energy efficiency and circular economy

The time limit for the business presentation is 20 minutes, not including question and answer time. Question and answer time will not exceed 10 minutes.

The team may receive up to 25 points for their business presentation. Partial points will be awarded per discretion of the judges.

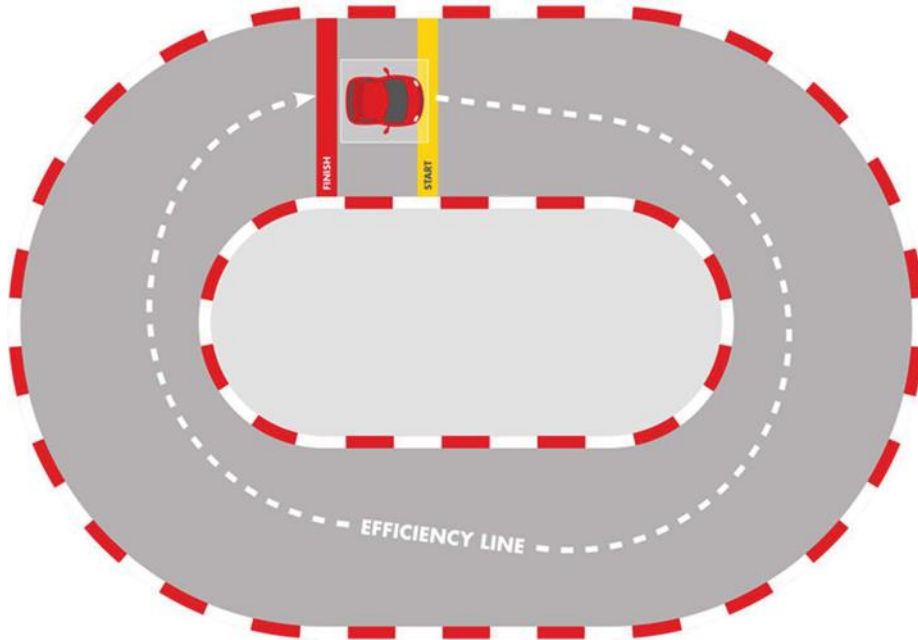
## **6. DEFINITION OF WINNER AND AWARDS**

The winner of the 2022 Shell Eco-marathon Autonomous Urban Concept Competition will be the team with the highest accumulated points across the four challenges. In the event of a tie, the Organisers reserve the right to select the winning team.

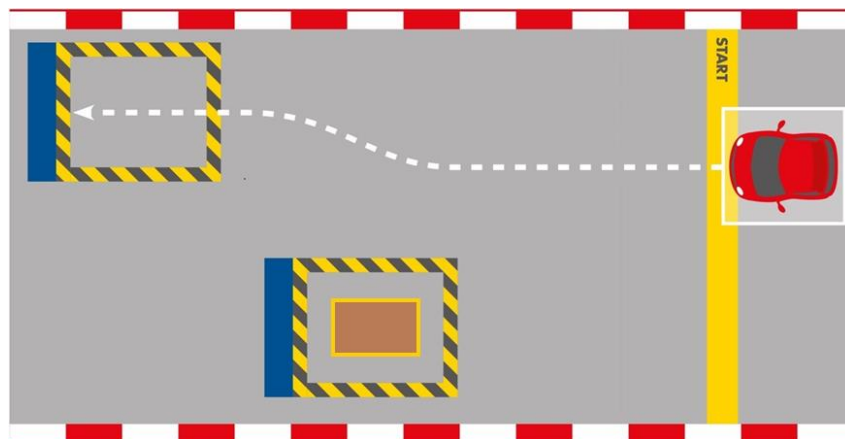
A prize of \$ 1,500 will be given to the overall winner.

**APPENDIX: VISUAL ILLUSTRATION OF CHALLENGES**

Please note that the following illustrations are intended to demonstrate the general principle of each challenge. These images do not represent the final challenge and track layouts are not to scale.



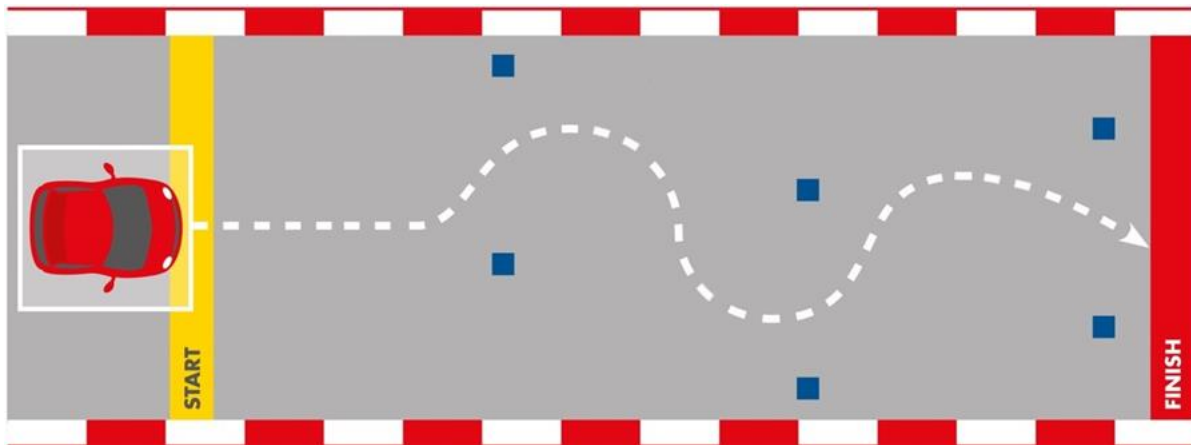
CHALLENGE 1 SCHEMATIC: AUTONOMOUS DRIVING



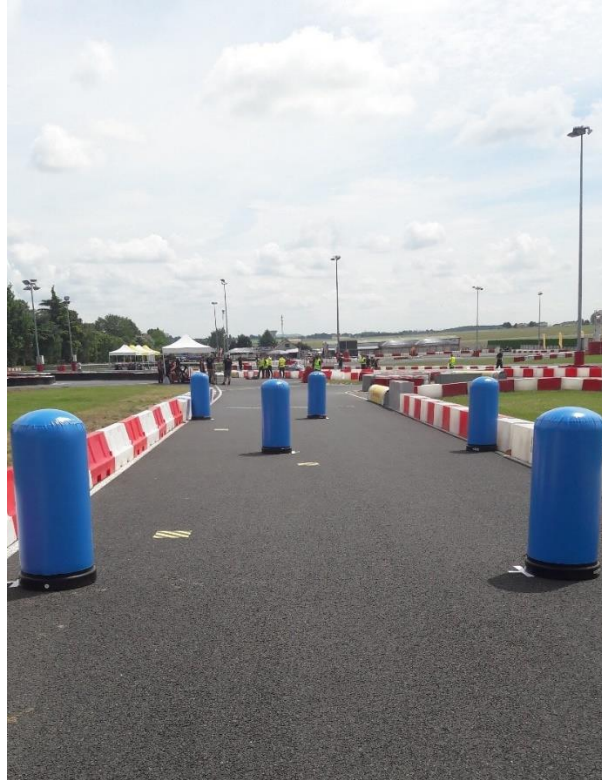
CHALLENGE 2 SCHEMATIC: PARKING MANOEUVRABILITY



CHALLENGE 2 PHOTO: PARKING MANOEUVRABILITY



CHALLENGE 3 SCHEMATIC: OBSTACLE AVOIDANCE



CHALLENGE 3 PHOTO: OBSTACLE AVOIDANCE