

Terms and Conditions

AUTOTRAC 2020 – DG JRC, EC

Introduction

Connectivity and automation are expected to bring a deep transformation in the automotive industry and the transportation networks. The European Commission took a prominent role in the deployment of connected driving, by setting up a C-ITS Deployment Platform on 2014 (European Commission, 2014). In the final report of the C-ITS Platform (European Commission, 2017) it is mentioned that for cities across the EU, the potential arrival of automation raises the prospect of safety issues, increased traffic and consequently worsened pollution and congestion, if not tailored and shaped towards the needs of local authorities. A main report conclusion is the need for orchestration of services, that is, to put in place, when appropriate, the traffic management measures by the means of the different stakeholders, public and private, that are required to come together and act accordingly to pre-established agreements. However, the impact is still vague as current Automated Vehicles (AV) products do not focus on vehicles' cooperation (System-centric approach) but rather on individual performances (User-centric approach). Transport engineers agree that better ways of traffic management need to be investigated and JRC conducts already research towards this direction through the C2ART project¹.

The organization of a small-scale AUTOnomous vehicle TRAffic Challenge (AUTOTRAC) is funded by the JRC Exploratory Research Programme (ER activity). It aims to raising awareness on the potential impact of automated vehicles' cooperation in future transport networks. Are CAVs capable to do a better utilization of the network? Can they deliver the anticipated promises for less congestion, safer and greener mobility? **Promotion of the cooperation between AVs, more efficient energy consumption and the reasonable utilization of the transport network are the main pillars of the AUTOTRAC initiative.** AUTOTRAC is a competition of small-scale AVs asking the participation of students, universities, research centers and the makers' community. Each team participates with multiple AV robots that should demonstrate a) efficiency in automated driving and b) communication with the other AVs of the fleet for better network utilization. So, in contrast to currently running small-scale AV competitions, AUTOTRAC promotes the conceptualization and implementation of collaborative behaviors between robot vehicles.

General information

The competition is organized by the Joint Research Center (JRC) in Ispra. It will be held in spring 2020. Exact date and place will be communicated later.

The application will close on July 31, 2019 at 23:59 CET.

Confirmation of selection will take place by August 31, 2019, with notice to selected teams.

Confirmation of participation by teams will close on September 15, 2019. By confirming their participation, the teams will agree with the terms and conditions of the competitions and will send a photo of the team and/or of the available robots to be published on the web-page of the competition.

¹ <https://trimis.ec.europa.eu/project/towards-connected-coordinated-and-automated-road-transport-c2art-system>

Each team selected for participation in the JRC AUTOTRAC should provide specific documentation by the 15th of January 2020 (see qualification section).

The technical specifications will freeze one month before the competition. From that date, any clarifications on the rules will be published in a special FAQs section on the website or communicated directly to the participating teams by e-mail.

In order to apply, please fill in the application form below before the deadline:

<https://ec.europa.eu/eusurvey/runner/JRC-AUTOTRAC-2020>

For further questions regarding the JRC AUTOTRAC please contact JRC-AUTOTRAC@ec.europa.eu

Participation

Admission to the AUTOTRAC competition is subject to the following conditions:

- **The maximum number of registered teams is 12.** If more than 12 teams apply, a group of JRC experts will select the best 12 teams in terms of motivation and past experiences.
- **Up to 4 members of each team are allowed** to attend the competition in the Ispra premises of the JRC. Each team should participate with exactly 4 vehicles.
- **The three top performing teams will be awarded with appealing prizes, while the best performing team will have the opportunity to demonstrate, free of charge, their performance during the 2020 Transportation Research Arena which will be held on April 27-30, 2020 in Helsinki (<https://traconference.eu/>).**
- **The JRC will provide financial support for travel and accommodation for up to 5 teams. The JRC reserves the right to choose the 5 teams to support on the basis of the information provided in the application.**
- **There is no admission fee for the competition**
- Participants must be over 14 years old at the start of the competition. At least one of the team member shall be at least 18 years old.
- Each team will have to indicate a contact person who will interact with the organizers of the competition.
- The possibility of having additional visitors for each team will be confirmed, after defining the exact location of the competition.
- A technical area will be available to the teams near the competition area with 220V electric power supply.
- By registering, every team and every participant declare their agreement with the publication of image, video and audio recordings. This also includes the recording of team presentations.
- JRC will offer to all participants snacks, coffee and lunch, while the first day there will be a dinner in the JRC premises.
- The participants accept a JRC referee team that will decide the final ranking and will be responsible to solve any objections or problems that may arise.

Vehicle requirements

This section describes the regulations related to the vehicle requirements. Violation of these requirements will lead to exclusion of the competition.

For each vehicle the following should apply:

- The robot must be registered before the competition. The registration process includes technical inspection of the robot, marking the robot with a color sticker and testing of the remote start and stop function.
- Technical inspection must be completed by the time specified by the organizers.
- The robot must not damage the field or endanger the spectators in any way.
- The robot must be completely automated. Any kind of interaction with the team members or any other remote entity during the competition is forbidden.
- The robot must have a remote from where the robot can be only started or stopped.
- The vehicle should be equipped with an electric motor.
- Energy must be supplied with batteries. Max Voltage battery 24V or LiPo 6S (22,2V).
- Changing and charging batteries is allowed.
- The vehicles must be based on a chassis with maximum dimensions 150x200 x200mm (width x length x height).
- The vehicle's maximum weight should be 2kg.
- The sensor setup can be arbitrarily chosen by the teams. Laser sensors are allowed only up to class 2 devices.
- Reference standard for laser devices: IEC 60825-1: 2014
- Only sensors for external lines/spaces recognition can exceed the dimensions of the robot by a maximum of 3 cm on all sides.
- There is no limitation to the use of robotic platforms and sensors.
- During the competition (2nd day) both hardware and software of the vehicle must not be modified except in case of supervised repair.
- To facilitate the recognition of the 4 robots by the judges and the camera, a sticker with a different color (red, green, blue, yellow - 3cm diameter) will be provided by the organization. The robot must provide a flat space on top to position this sticker.

Tracks

This section describes the specifications of the track where the scenarios will take place. There will be 2 tracks.

J-shape track: The J-shape track, represents highway traffic conditions. It is a one-lane track with the shape of the letter 'J'. Regarding its dimensions, the track will be enclosed in a rectangle of 4x3 meters. The width of the lane is 300mm.

The minimum turning radius of the line is 400mm (in the middle of the lane).

The track will be crossed by a vehicle (obstacle) that will move forward and back along a white line (like a tram). If the robot touches the obstacle, it will be penalized. The size of the mobile obstacle is approximately 150x150x150mm.

On the sides of the path there is the parking area, printed in green ink.

Each vehicle is eligible to move freely within the road surface. An illustrative representation of the track is depicted in Fig. 1.

#-shape track: The #-shape represents urban traffic conditions. It is a one-lane track with 12 intersections. Regarding its dimensions, the track will be enclosed in a rectangle of 4x3 meters.

The width of the lane will be 250mm. An illustrative representation of the track is depicted in Fig. 2.

The black lane is surrounded by 35 cm of free-white space on both sides. The minimum space from the outer edges is 25 mm.

On the #-shape track, there will be test areas for the colors and the type of traffic signs.

The material for both tracks will be rigid panels (FOREX thickness 5mm), with white background and black the surface of the road/lane. Everything will be printed in four-colour ink process (CMYK).

The colors used in the tracks and in the road signals are:

White	CMYK: 0, 0, 0, 0	RGB: 255, 255, 255
Black	CMYK: 0, 0, 0, 100	RGB: 0, 0, 0
Red	CMYK: 0, 100, 100, 0	RGB: 255, 0, 0
Green	CMYK: 100, 0, 100, 50	RGB: 0, 128, 0
Blue	CMYK: 100, 100, 0, 0	RGB: 0, 0, 255
Yellow	CMYK: 0, 0, 100, 0	RGB: 255, 255, 0

Scenarios and objectives

There are two test scenarios in the JRC AUTOTRAC competition, one scenario corresponding to highway conditions, another to the urban driving. The layout of the two test tracks are reported in Figure 1.

Highway Scenario and parking (J-shape track)

The Highway scenario takes place on the J-shape track. Each team sets up all four vehicles in the track. The 4 robots will be positioned on the red START line in a straight line. Intervehicle distance will be set to 5 cm. At their starting position, the vehicles must be positioned with both wheels on a portion of the black track; only the sensors (extra 3 cm) can be on the white background. The vehicles should drive as fast as possible and on the same time they need to keep as close as possible to each other without creating or being involved in an crash (accident), for the whole duration of the test which is 3minutes. At the end of the 3 minutes the 4 robots will have 1 minute to park in the space without touching. An additional score will be given for each correctly parked robot. The parking area will be indicated by a white arrow on a green background. Each team has 10 minutes available to position the vehicles, start the test, complete it and park the vehicles). Teams that do not manage to finish, won't be scored. The scoring of the teams that will finish depends on an automated camera-based system and the penalties based on the ineligible behavior as described in the "Scoring and Evaluation" section.

Urban Scenario (#-shape track)

The Urban scenario takes place on the #-shape track. Each team sets up all four vehicles in the four different initial positions of the track. A color is assigned to each vehicle. At their starting position, the vehicles must be positioned with both wheels on a portion of the black track; only the sensors (extra 3 cm) can be on the white background. The vehicle should be able to recognize it through its sensors. In every intersection of the track there are signs for each of the colors. The vehicles should follow as quickly as possible the paths indicated by the signs of their assigned color without creating or being involved in a crash (accident), for the whole duration of the test which is 3minutes. Each team has 10 minutes available to position the vehicles, start the test and complete

it. The scoring of the teams that will finish depends on the automated camera referee and the penalties based on the ineligible behavior as described in the “Scoring and Evaluation” section.

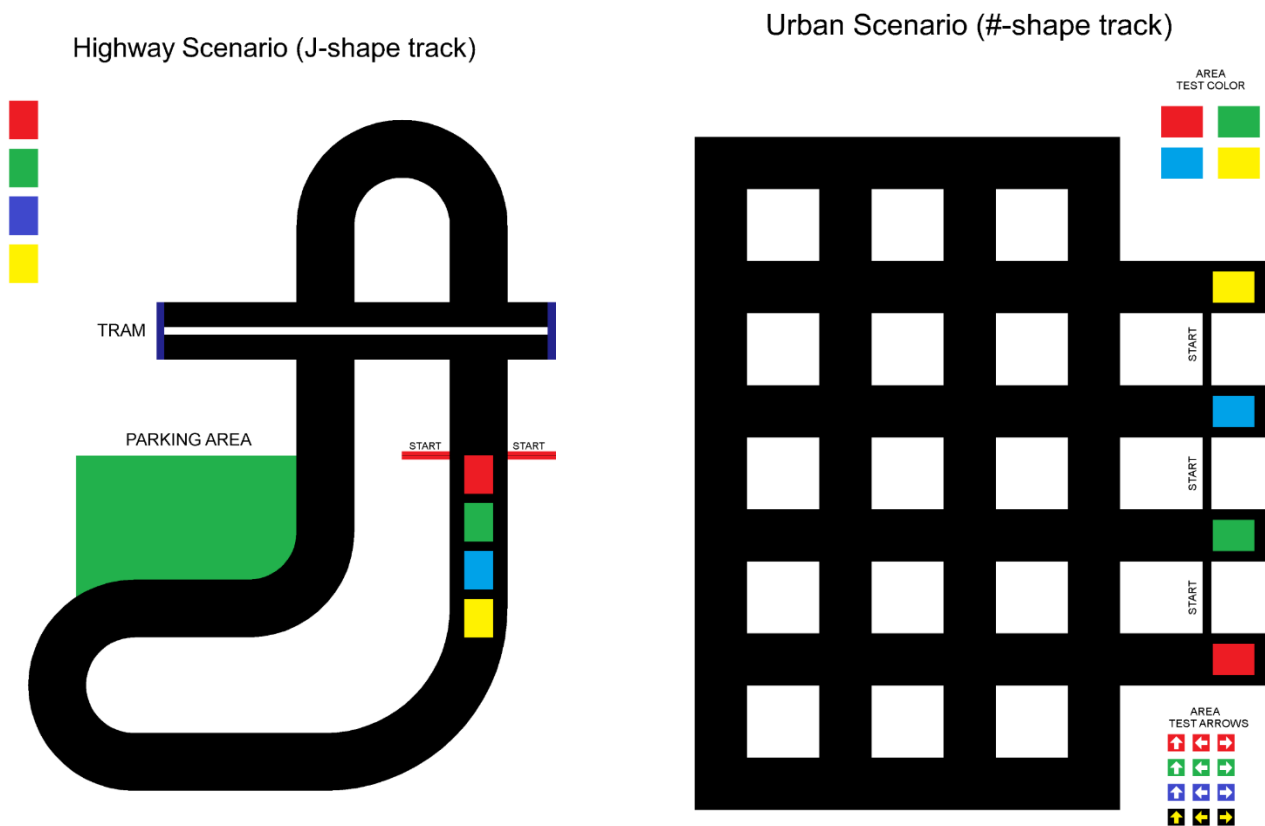


Fig. 1. Networks layouts for the AUTOTRAC Competition. On the left the J-shape track corresponding to highway conditions. On the right the #-shape track corresponding to urban conditions.

Mixed tests (J-shape track)

After all teams will have completed their tests, they will be randomly divided in 4 groups. Per each group, each team will made available one vehicle. An additional vehicle is made available by the JRC. The four newly formed fleets of four vehicles will repeat exactly the same tests described in the previous section for the highway scenario. In this case the JRC vehicle will be the leading vehicle, and the others will follow. In these tests the vehicles will not be able to cooperate but still they have to prove their capability to move safely and efficiently. Vehicles able to stay safely close to the vehicle ahead will be awarded with additional points. Vehicles involved into crashes will be penalized. The objective of these tests is to show the effect of the lack of cooperation on safety and driving efficiency.

Traffic signs

There will be three types of traffic signs in the Urban Scenario to signal vehicles to move forward, turn right and turn left. All signs are made in 8 cm diameter as shown in Fig. 3. Some of them will be placed at every intersection, on the right of the lane, at a height of 10cm from the ground as shown in Fig.3. Three signs will have a color background (Red, Green, Blue), and a white arrow in

the middle to indicate three different directions. One sign will have a Black background and a Yellow arrow.

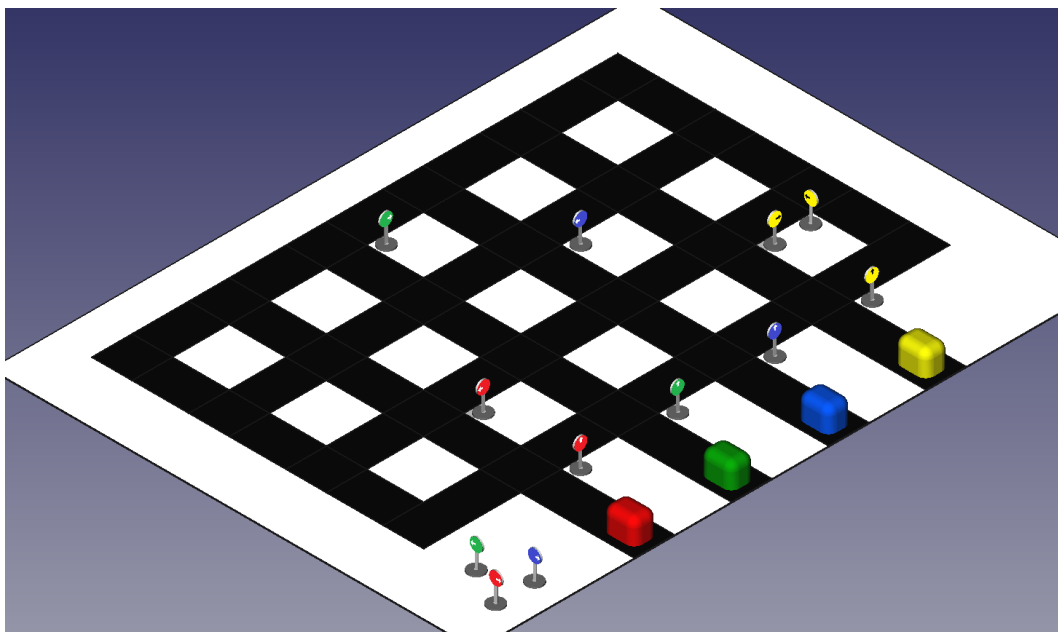
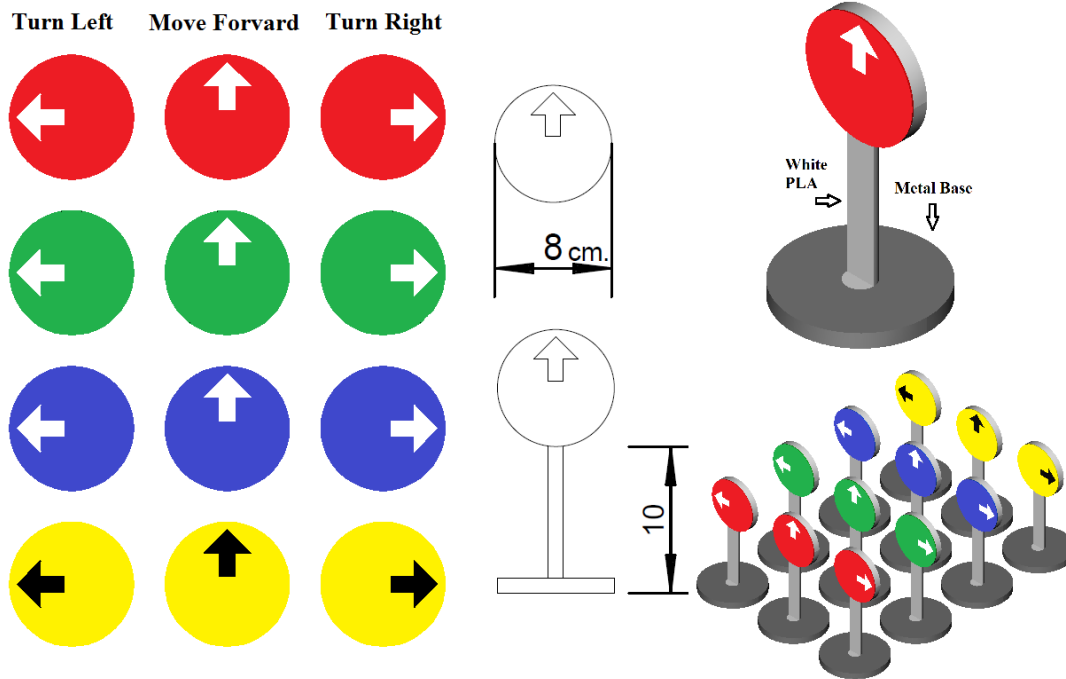


Fig. 3 The traffic signs.

Scoring and Evaluation

The scoring for each team that participates in the competition will be comprised by the aggregated scoring between presentation and competition. The evaluation will be performed by a group of individuals referee experts (IRE) and by an automated camera-based referee system (ACRS).

The final score of each team will be a weighted combination of the scores achieved for the presentation, documentation and performance in the scenarios. Positive points will be given according to composite metrics and negative points will be deducted if the vehicles collide, move outside the track or don't manage to finish. The metrics are designed with focus on best utilization of the network's capacity, energy consumption and vehicle platoon stability.

Full details about the metrics used and the scoring system will be provided to the 12 selected teams confirming their participation to the competition.

Competition schedule

Preparation

Each team shall apply using the template available in the JRC AUTOTRAC website, and shall accept the AUTOTRAC regulations. After the deadline of the call for participation, each team will be contacted by JRC for the notification of acceptance or not and for further information.

Qualification

Each team selected for participation in the JRC AUTOTRAC should provide the following by the **15th of January 2020**:

- A video file with at least 2 vehicles:
 - a) following each other on a ring-road track for 30seconds and
 - b) drive straight and avoid a static obstacle.

Competition

The competition will last 2 days. The first day all the participant teams should present their models. For each presentation the 20-slide 20-second format with automatic scrolling must be used. At the end of each presentation the assessment panel will have the possibility to pose 1 question. Every 10 minutes there will be the next presentation. The first day it will also be possible for the teams to check the performance of their robots on the tracks. The second day, the participant teams will compete based on the scenarios described above.

The competition will be held simultaneously on the two tracks/scenarios.

The routes will be always time same, while the position of the road signs may vary test to test.

The participation order will be random and extracted on the day of the competition. The team that will participate in the **J-shape track** first, will be the last of the **#-shape track** and so on.

Further information will be communicated to the teams and advertised on the JRC AUTOTRAC website as we approach the date of the competition.

Indicative agenda – JRC-AUTOTRAC 2020

1 st day	2 nd day
8:00 – 9:00 Welcome – Registration 9:00 – 10:00 Registration – Technical Check 10:00 - 13:00 Presentation (150' + 30' buffer) 13:00 – 14:30 – Lunch – Technical Break 14:30 – 17:30 – Free Test Robots 18:30 – 21:00 – Buffet/Dinner	8:00 – 9:00 Welcome 9:00 - 13:00 Competition (150' + 90' buffer) 13:00 – 14:30 – Lunch – Technical Break 14:30 – 16:00 – Sharing/Networking (& scoring) 16:00 – 17:00 – Awards – (See you next year 😊)