




# Improved Robotic Platform to perform Maintenance and Upgrading Roadworks: The HERON Approach

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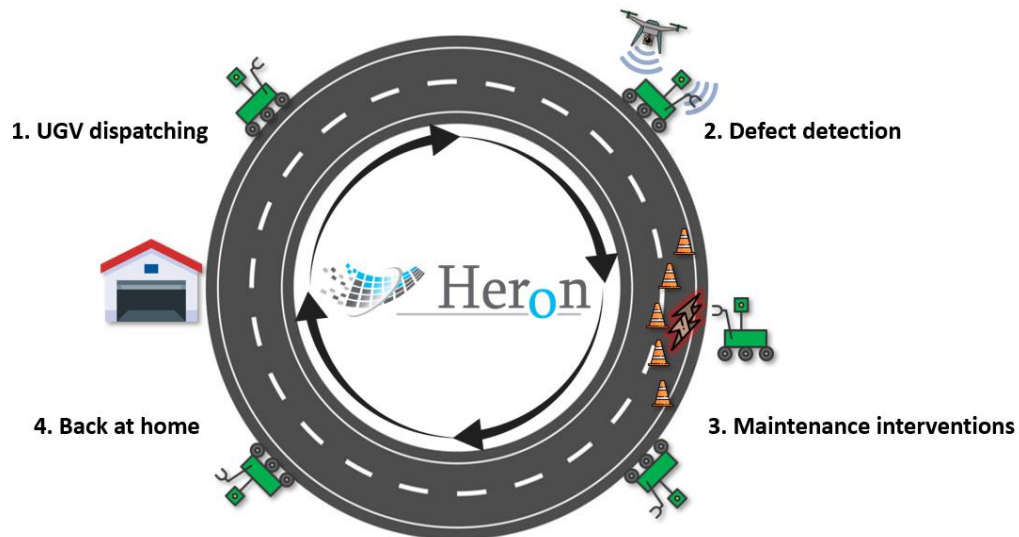
## Document Control Sheet

Version history table			
Version	Date	Modification reason	Modifier
0.1	01/04/2022	Basic structure of the deliverable	Iason Katsamenis
0.2	01/05/2022	Figures and infographics of the deliverable added	Iason Katsamenis
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# Improved Robotic Platform to perform Maintenance and Upgrading Roadworks: The HERON Approach



**HERON** aims to develop an integrated automated system to perform maintenance and upgrading roadworks tasks, such as sealing cracks, patching potholes, asphalt rejuvenation, autonomous replacement of CUD elements and paint markings, but also supporting the pre-/post-intervention phase, including visual inspections and dispensing and removing traffic cones in an automated and controlled manner.

**HERON** will allow for a modular design of the system operation, maximizing its

capabilities and adaptability for various transport infrastructures, while reducing fatal accidents, maintenance costs, and traffic disruptions, thus drastically increasing the network capacity and efficiency.

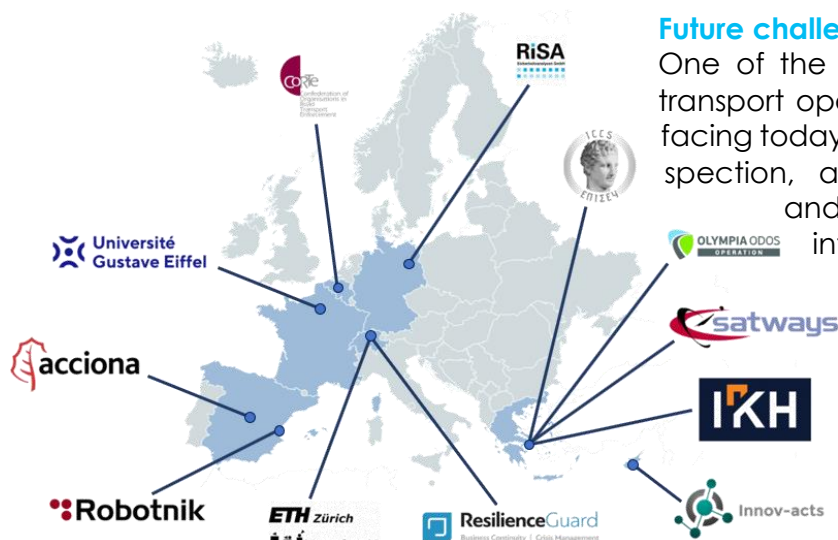
**HERON** belongs to societal challenges - Smart, Green And Integrated Transport, of EU's Horizon 2020 framework. The project was launched in June 2021 and will run for 4 years (48 months), to allow enough time for the development and validation of the applied technologies.



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### HERON Consortium

- **Institute of Communications and Computer Systems** (Greece)
- **Acciona Construcción S.A.** (Spain)
- **Olympia Odos Operation S.A.** (Greece)
- **Université Gustave Eiffel** (France)
- **Eidgenössische Technische Hochschule Zürich** (Switzerland)
- **Robotnik Automation** (Spain)
- **Confederation of Organisations in Road Transport Enforcement** (Belgium)
- **SATWAYS - Proionta Kai Ypiresies Tilematikis Diktyakon Kai Tilepikinoniakon Efarmogon Etairia Periorismenis Efthinis EPE** (Greece)
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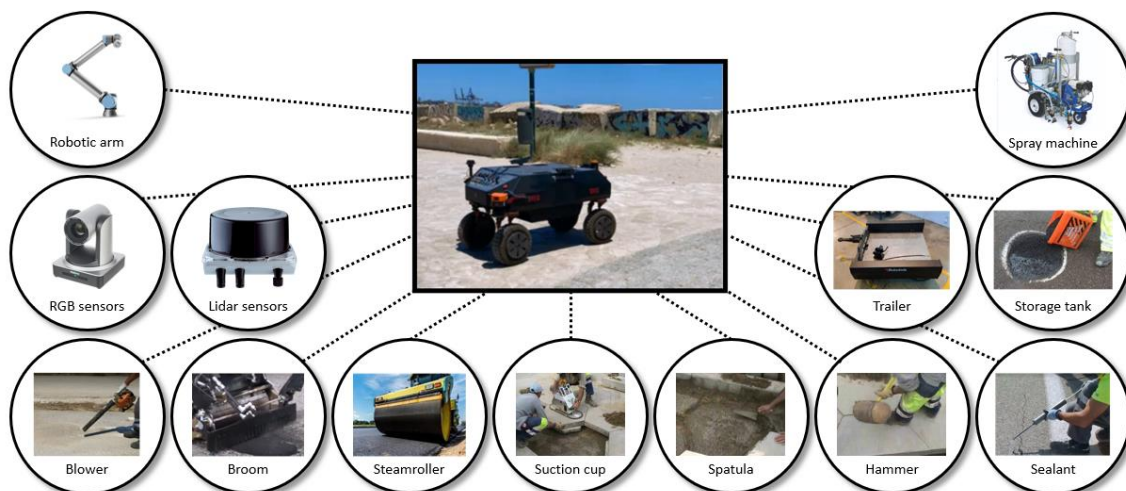
### Future challenges

One of the greatest challenges, that transport operators and engineers are facing today, is the fast and efficient inspection, assessment, maintenance, and safe operation of existing infrastructures, including highways and the overall road infrastructure network. Factors such as ageing, climate change, extreme weather conditions or other natural and manmade hazards, increased traffic conditions, inadequate maintenance, and deferred repairs lead transport infrastructures (including railways, etc.) to progressively deteriorate and lose of their durability. This results in the urgent need for inspection, assessment and repair work.

### HERON Technologies

The **HERON** system consists of:

- An autonomous ground robotic vehicle supported by drones
- Various robotic equipment, including sensors and actuators
- Sensing interface to allow improved monitoring (situational awareness)
- The control software that interconnects the sensing interface with the actuating robotic equipment
- Augmented Reality visualization tools
- Artificial Intelligence-based toolkits



### Spanish demo case in A2 motorway

The motorway is owned by the Spanish National Road Authority and the section selected has a length of 77.5 km. The section has 4 lanes (2 per traffic direction) and crosses a region with a Continental-Mediterranean climate, with long and severe winters, long, dry and hot summers, and high heavy traffic levels, so its pavement is exposed to severe requirements and maintenance is crucial to preserve the optimum pavement conditions required. A2 is one of the main motorways in Spain, connecting Madrid with Barcelona as part of the Trans-European Transport Network (TEN-T) and the CEF corridor.

Torija's traffic control center is in charge of monitoring the motorway status, visualizing and assessing the data provided by CCTV, inductive loops, GPS-based fleets, weather stations, weigh in motion systems, etc. It is also the base-camp for all assets needed for maintenance (e.g., machinery) and can be the ideal location for the preliminary trials of the different functionalities and robotic abilities developed in **HERON**.

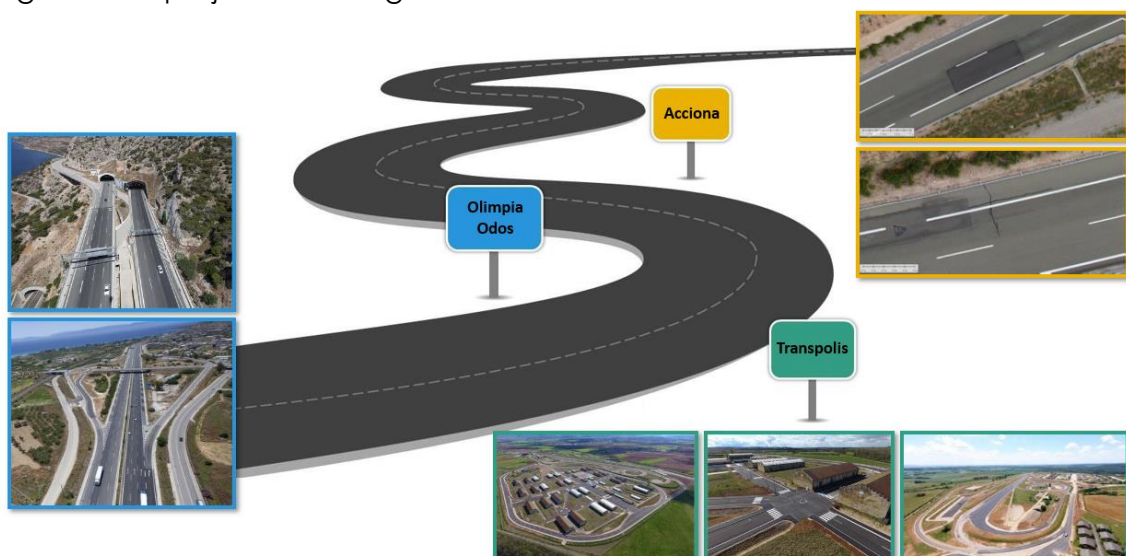
The tailor-made image processing and computer vision system installed in the robotic vehicle will be validated, using real video and images, and correlated with the information included in the existing road project and gathered

during regular visual inspections and general patrolling. The performance and efficiency of the road infrastructure maintenance and upgrading functionalities developed and integrated into the autonomous robotic vehicle will be evaluated as well.

After the initial validation of the automated vehicle and maintenance and upgrading functionalities, if the traffic authority permits the use of automated vehicles, a full-scale trial in a controlled stretch with certain defects and maintenance/upgrading needs will be carried out counting on the support of the Spanish National Roads Authority.

### French demo case in Transpolis

Transpolis is a proving ground of more than 80ha, which has been created by 5 entities, among which is the UGE, and has been opened officially in 2019. It is typically used to test autonomous vehicles in a secure and controlled environment, also by assessing the V2I communication possibilities (several types of Road-Side Units and communication means) are already installed on-site. It is also composed of several kilometers of road and all reinforced concrete buildings. Many types of V2X and I2V communication means are available, as well as camera monitoring, which can be used during the **HERON** project activities.



Another experimental site, part of the French project R5G, is proposed: the site LaVallée, also called E3S, is an urban development project at the former place of Ecole Centrale de Paris where several new mobility infrastructures and services will be implemented to create an evolutive, energy-neutral and cooperative road. In particular, the concept of removable urban pavement (RUP) will be studied, using prefabricated hexagonal concrete slabs. These removable tiles allow quick access to networks, improve the durability of surface properties of roadways, and in parallel can be recycled. Their prefabrication should make it possible to offer other integrated functions (various textures, porous, silent, or depolluting surfaces, insertion of sensors, etc.). Currently, this RUP concept is not fit for TEN-T traffic, so inspecting these tiles regularly for cracks as well as repairing them is a crucial task. The damages are spalling at the interfaces between RUP elements and cracks among them. Conventionally, their initial installation and their replacement are carried out with motorized arms controlled manually by a human operator.

Transpolis will provide a testing ground for the following technical objectives:

- Inspection and renewal of faded road markings.
- Inspection of reinforced concrete wall and filling of cracks.
- Testing of the positioning of the robotic vehicle and its components.
- V2I communication, replacement of part of the infrastructure.

### Greek demo case in Olympia Odos

Olympia Odos has undertaken the traffic management and routine maintenance of the Elefsina-Korinthos-Patra motorway (in the heart of the Greek highway networks), which has 202 km total length and includes more than 25 km of tunnels and a large number of bridges, culverts, and ancillary

structures. It includes corrective and preventive maintenance both of civil works equipment and Early Equipment Management of open roads and tunnels. Olympia Odos will provide a part of the motorway, where extensive tests of the automated vehicle can take place, issuing the necessary permits in cooperation with the relevant Authorities (Public Service & Traffic Police) and ensuring safety conditions for road users and people working on the project.

**HERON** will be applied in a pilot manner aiming at the increase of users' safety and reduction of traffic disruption and maintenance costs. As far as routine maintenance is concerned, the related areas are mainly civil works such as the horizontal signing and the pavements. The proposed **HERON's** automated platform could implement maintenance works on horizontal signing and pavements by painting road marking and sealing pavements cracks and patching potholes, respectively.

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