



# SUCCESS STORY

## VEHICLE, ENVIRONMENT, BEHAVIOUR: REAL-TIME SIMULATION

*“We see enormous potential in the interactive simulation with RODOS for construction machinery and commercial vehicles, in order to sustainably and profitably expand our development and testing activities in Konz.”*

Martin Frank  
AE Program Leader Machine  
Intelligence & User Experience

Possibilities and requirements for simulation in vehicle engineering have increased considerably over the last 30 years. From component simulation to system simulation of entire vehicles, additional consideration is now given to the driver and the environment. REDAR and RODOS® support these new challenges in the engineering process, starting with three-dimensional environment acquisition up to test drives in the driving simulator.

### Where do we get the environmental data?

The REDAR measuring vehicle (Road&Environmental Data Acquisition Rover) uses two 360-degree laser scanners to record its environment with high accuracy at normal driving speed. As a result of the measurement, a three-dimensional image of the environment in the form of a point cloud is obtained. Data volumes of several terabytes are not unusual. One possible application is, for example, the realistic 3D environment representation in a driving simulator. The greatest challenges are setting up such a complex measuring system and developing suitable algorithms to consistently process the data. The measurement vehicle has been in service, busily collecting data for individual customer projects, since 2015.

### What happens to the data?

ITWM's driving simulator RODOS® (RObot based Driving and Operation Simulator) processes the measurement data from REDAR as input for simulation and visualization. Various cabins equipped with control elements like the steering wheel, gas pedal, and brakes can be mounted on the six-axis robot. When navigating interactively through the virtual world, the robot moves the cabin in a way that corresponds to the feelings of acceleration, braking, or taking tight curves normally felt by the driver. The optimization of the perception of reality, currently is the subject of a dissertation in psychology.





### The road network as the database

The simulations are supported with information from the Virtual Measurement Campaign VMC<sup>®</sup> database system. The world's road network with its topography, regulations, weather information and other geo-referenced data is stored there. With the help of special statistical methods, the scenarios that are considered important and representative can be filtered out for more detailed investigations with REDAR and RODOS<sup>®</sup>. Linking these two worlds is a major step in determining efficient and targeted test scenarios for road vehicle design. The current state of research focuses on the definition of reference routes and the search for the ideal testing environment: for example, is there a real city somewhere that has a representative mix of the major test parameters for various cities or even for all urban scenarios?

In addition to virtual testing of driver assistance or autonomous systems, this development environment also allows an efficient and flexible investigation of fuel consumption and emissions: A wide variety of test scenarios can be categorized, weighted and realistically compared. VMC<sup>®</sup>, REDAR and RODOS<sup>®</sup> represent a flexible and universally applicable tool chain to describe the interaction between humans, vehicle and environment.

### RODOS<sup>®</sup> technical data

- Design and construction time: 2009 – 2012
- 18 projectors for all-round visibility in the projection dome (diameter: 10 meters)
- Resolution: 11520 × 3600 Pixels
- Six-axis industrial robot enables wide field of maneuver and large tilt angle
- Interchangeable cabins (currently: excavators, cars, tractors)
- Payload: 1000 kg



*On the move with REDAR:  
360-degree laser scanners  
detect the environment  
with high accuracy.*

