HORIZON 2020

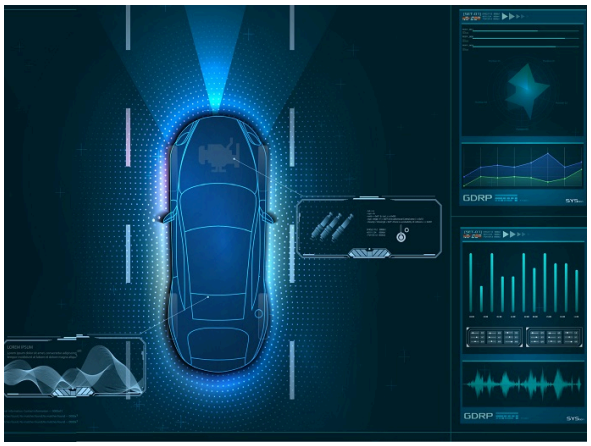
# European Initiative to Enable Validation for Highly Automated Safe and Secure Systems

## Results in Brief

# Virtually testing the autonomous systems of tomorrow

Researchers with the EU-funded ENABLE-S3 project have developed virtual verification and validation methods and procedures for testing highly automated cyber-physical systems.

INDUSTRIAL TECHNOLOGIES



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From the way we drive to how we receive medical care, autonomous systems are redefining the way society works. Not only will these systems simplify our daily lives, many will also help save natural resources, increase efficiency and reduce pollution. However, in light of several deadly accidents caused by autonomous vehicles, there is growing concern about how best to ensure the safety of these systems.

Unfortunately, it is simply too costly and too time-consuming to conduct real-world tests for all possible use scenarios. For example, it would take more than several million kilometres of road driving to statistically prove that an automated vehicle is as safe as a manually driven one. Similarly, the complex automated medical devices that could one day assist doctors during difficult operations face strict restrictions on human testing.

This lack of an effective method for testing creates a significant barrier to these systems ever reaching the market. That is why the EU-funded ENABLE-S3 project has developed virtual verification and validation methods and procedures for highly automated cyber-physical systems. “It is commonly accepted that virtual testing, done in combination with real-world testing, is necessary to bring these systems to market,” says Sarah Woywod, ENABLE-S3 project coordinator. “But virtual testing requires new methods and corresponding tools, which was the focus of our research.”

## Brick by brick

Building on the work of previous projects such as CRYSTAL, RobustSENSE, MBAT, Acosar and PEGASUS, ENABLE-S3 researchers set out to provide a virtual means for verifying and validating automated cyber-physical systems. “One major goal of the project was to deliver reusable technology tools – called bricks – and seamless development environments,” explains Woywod. “Technology bricks promote the development of models and tools that are easily reusable in different contexts.”

Using these technology bricks, the project successfully created a generic testing architecture for validating highly automated systems. The architecture is applicable to all six of ENABLE-S3’s focus areas: automotive, aerospace, rail, maritime, healthcare and farming. This architecture was applied to 12 use cases and 45 demonstrators, including an autonomous parking function for vehicles, a situational awareness function for automated tractors, and an MRI system capable of automatically adapting to an individual patient’s needs.

## A push towards standardisation

According to Woywod, the project succeeded at defining the essential interfaces used in the various bricks developed: “Using the ENABLE-S3 results, we made a significant effort to initiate or actively influence the creation or extension of standards for the testing and validation of automated systems. These standardised interfaces are already being used both by project partners and by many companies outside the project.”

As this is an ongoing process, project researchers are continuing to develop new methods and tools for testing and validating these systems. “The end goal is to have virtual verification and validation methods that address the entire value chain and life cycle of automated systems,” adds Woywod.

## Keywords

ENABLE-S3, autonomous systems, virtual verification, automated cyber-physical systems, autonomous vehicles

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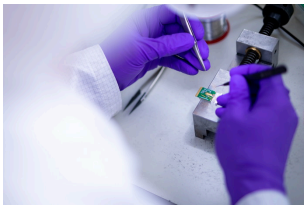

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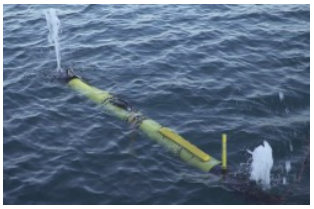

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Project Information

**ENABLE-S3**

Grant agreement ID: 692455

Project website

**DOI**
10.3030/692455

Project closed

**EC signature date**
11 May 2016

**Start date**
1 May 2016

**End date**
31 May 2019

**Funded under**
INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT)

**Total cost**
€ 63 381 009,78

**EU contribution**
€ 15 896 355,31

**Coordinated by**
AVL LIST GMBH
Austria

**Last update:** 31 October 2019

**Permalink:** https://cordis.europa.eu/article/id/411450-virtually-testing-the-autonomous-systems-of-tomorrow