

Sensor and System Validation

Our Sensor and System Validation offering helps automakers and their partners deliver complex sensor systems, bringing a consistently high level of detail to every area of testing and analysis. We cover the end-to-end system test and validation of sensor systems within a vehicle — for all sensor types across the visible and non-visible spectrum, such as radar, LiDAR, camera and ultrasonic sensors. Our services include prototyping, test drives, data validation services, test environment setup and operation, calibration, and measurement technology. Furthermore, we support automakers and their partners with validation concepts and consulting services to accelerate the development of robust and accurate Advanced Driver Assistance Systems (ADAS) and Autonomous Drive (AD) systems.

The challenge

Increasing regulations and standards for assistance and safety systems are coming into force. At the same time, market demands for high-level automated systems are growing. As a result, players in the automotive industry need to raise their testing effort for complex systems like adaptive cruise control (ACC) or highway pilot. We support our clients with customized solutions for the validation of such systems, addressing upcoming challenges such as the need to:

- Meet NCAP and other regulatory requirements worldwide
- Deliver highly automated driving systems for SAE level 3 and above
- Enable end-to-end perception testing of environmental data
- Check the valid reaction of fusion and synchronization systems

Our solution

Accurate real-time perception of environmental data is crucial for sensor systems. To validate the output of such systems, Luxoft builds up prototyping vehicles with reference systems that deliver data of higher precision and accuracy than the system under test. We gain such data in real-world situations on the road and in specified scenarios on a proving ground. By applying our data services to the test database, we generate enriched classified ground truth (GT) that forms the basis of the validation process. Regardless of the requested type of annotation — box, semantic, key point or tags — we offer flexible solutions for the extraction of validation data to analyze the performance of our clients' systems.

The fundamental aspect of a reference system is the calibration of its sensors, especially for fused systems. We offer sensor fusion, calibration and time synchronization as well as the design and build-up of the required measurement and logging technology. In addition to the integration into the

prototyping vehicle, Luxoft assumes responsibility for maintenance and management of the entire test vehicle fleets operating worldwide.

Moreover, we take care of:

- Updates for vehicle electronics and software
- Logistics and parts management
- Prototyping of customer-specific covers and brackets
- Setup of hardware-in-the-loop (HiL) test benches and farms

The application of HiL in simulations is another main area of expertise, covering closed-loop restbus testing as well as open-loop data injection testing.

All our systems are maintained from the conception phase to commissioning. In addition to test vehicle handling, we offer support in the certification of series production vehicles to obtain approval for a specific market. With our proving ground test strategy — covering all client needs from shipment to reporting — we conduct automated testing, thereby meeting all requested norms and regulations (such as NCAP and NHTSA).

Our ADAS system landscape covers everything from virtual testing in the lab to real-world testing on the road.

Our customers

Challenge

A German automotive supplier requested the validation of a radar system. The assessment had to cover the test design, the validation process itself and a final test report with release recommendations. The challenges included:

- Performing a comprehensive benchmark with the client's radar sensors and comparable ones
- End-to-end validation of radar for mass production
- Setting up a validation database
- Reprocessing data in SiL and HiL environments
- Analyzing and evaluating simulation results

Solution

Luxoft provided an experienced team of 30 engineers — including project managers, software developers, system test engineers and test drivers — and a 40-person team of data analysts and annotators over the course of 3 years, conducting the following tasks:

- Review of requirements and derivation of test cases
- Test vehicle setup with radars and reference sensors
- Measurement system build-up and integration into the test vehicles
- Tests on proving ground and real-world data acquisition
- Data management and data platform development
- Specification of data annotation guidelines for ground truth generation
- Development and integration of intelligent annotation and analysis features
- Annotation of radar point cloud data
- Test execution in SiL and HiL simulations
- Analysis of performance output and handover of final sensor evaluation

Results

With our solution, the client achieved the following:

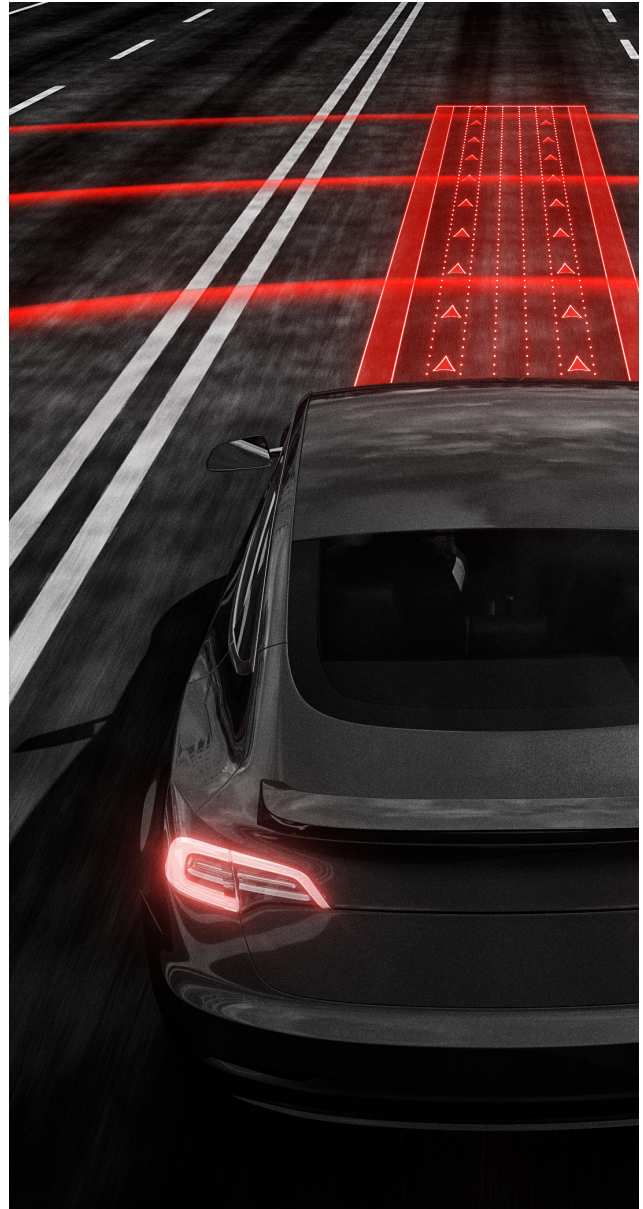
- Data infrastructure and platform to access and manage the acquired raw, annotated and analyzed data
- Detailed analysis of the in-house radar performance as a result of the benchmark
- Comprehensible release recommendations for radar sensor mass production

What makes us different?

- Fast project ramp-ups, realized with a mixture of onsite experts and talents at best-cost locations
- Global delivery within worldwide locations and access to TISAX-certified workshops and laboratories
- Extensive industry expertise in AD/ADAS sensors and measurement systems
- Flexible and client-oriented way of working, especially in the implementation of client-specific prototypes and parts
- Vast experience in testing on proving ground and performing test drives all over the world
- Automated test solutions for:
 - Extraction of GT data
 - Data anonymization
 - AI-supported test script generation
 - Proving ground tests with help of driving robots
 - Sensor calibration

Why work with us?

- Complete end-to-end testing capabilities aligned with intelligent test automation tools
- Flexible and client-orientated way of working with the ability to scale competitively priced solutions through nearshore and offshore delivery
- Compliance across a high number of industry standards
- Detailed reporting on project, process and product quality status — for total transparency of the testing and validation progress
- Fast identification and resolution of quality issues to preserve our clients' reputation



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