

Jaguar Land Rover

VERIFIED project

TNO | Knowledge for business



Overview project VERIFIED

Cooperation between:

TNO automotive, NXP semiconductors, ICT embedded, Verum, Eindhoven University of Technology

Project goals

- Develop tools to greatly improve development time of embedded software in automotive applications
- Demonstrate new technologies in a vehicle, focussing on Active Chassis systems

Technology

- Formal software verification to achieve virtually defect free source code
- Integrated Vehicle Dynamics Control
- Vehicle State Estimator, using GPS input when available
- Full active suspension technology
- By wire steering technology
- Electro-hydraulic braking
- Flexray control network technology

Finance

- Funded by Ministry of Economic Affairs
- Private funding by partners
- Total funding 5.6 million Euros

Planning

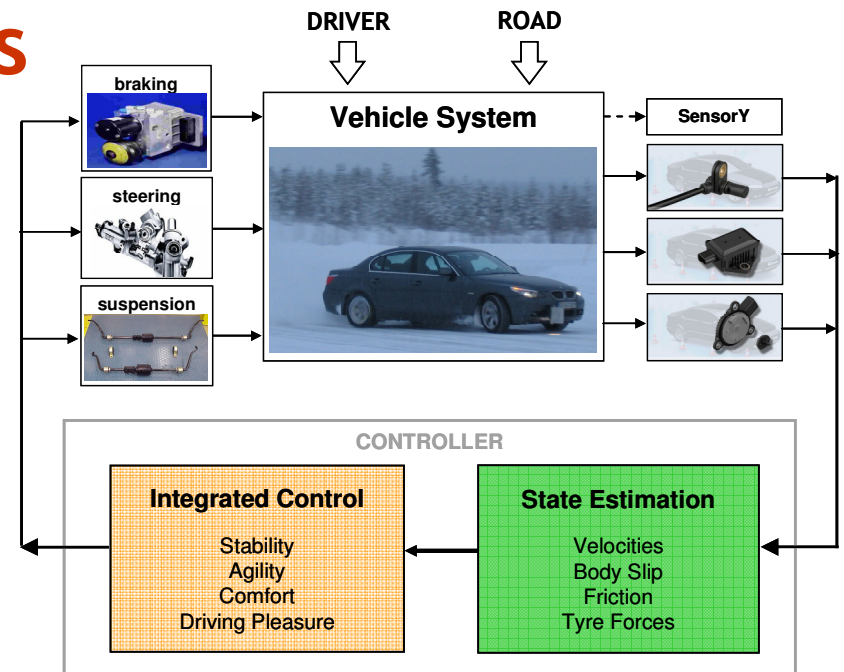
- Started in april 2009, due to finish technology demonstration in 2011.
- Market ready in 2013

Objectives

- **Reduce development time of embedded systems by:**
 - Automating source code generation
 - Easy control system tuning (brand specific tuning)
 - Decreasing necessary track testing time
- **Improve safety by optimally utilizing all available chassis systems and sensors**
 - Use all available sensor data to achieve maximum reliability in state and parameter estimation
 - Use modern optimal control methods to optimize vehicle behavior with respect to energy consumption, safety and brand DNA.
- **Increase reliability of embedded systems**
 - The use of software is rapidly increasing and so are the defects in the software. We aim to reduce the number of software related problems with at least one order of magnitude. To achieve this, model based software development and formal software verification are necessary.

Technology showcases

- Verification technology guarantees that the software is error free and complies to the specification and guarantees that the specification is both complete and correct,
- Integrated vehicle dynamics control using online optimization guarantees optimal performance under all conditions, even when systems fail or conditions change,
- Integrated Vehicle State Estimator using GPS sensor fusion (robust for GPS failure) gives reliable state and parameter estimation enabling optimal control,
- New active suspension technology featuring energy efficient active suspension with full active capability,
- By wire steering and braking showing full integrated control benefits,
- Flexray bus technology, time-triggered, fault tolerant and high bandwidth bus technology, featuring new network topologies.



Example of a Backbone Architecture with FlexRay

