# Volvo Drive Me: An Autonomous Driving Research Project

Tests Volvo's autonomous vehicle technology on public roads in Gothenburg, Sweden.

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for the project as referenced on 05/17/2017.


#### WHAT IT DOES

Drive Me is a multi-year research project run by Volvo Cars Group in which residents of Gothenburg, Sweden will participate in a test of Volvo's autonomous vehicle technology. Volvo's goal is to is to gain feedback from the participants' experiences as they interact with the technology, which will contribute to confirming the effectiveness and safety of autonomous technology.

In 2017, Volvo will recruit 100 local Gothenburg participants of varying ages and backgrounds to test highly automated vehicles (HAV) under real-world driving conditions on public roads. While the participants will be able to drive the test vehicles for their usual day-to-day needs (e.g., commuting to and from work), data will be collected on a pre-selected route, which includes approximately 50 kilometers of mapped geofenced roads. Geofencing uses GPS data to create a virtual boundary that determines where the test vehicles can safely travel. For the Drive Me project, the geofencing will allow the use of autonomous modes only on accurately digitally-mapped roads that are well understood by the researchers.

Volvo will be using hybrid XC90 sport utility vehicles for the Drive Me research. The test vehicles will feature Volvo's autonomous drive technologies, which use cameras, radar and Light Detection and Ranging (LIDAR) to detect and automatically respond to close- and long-range objects while driving at different speeds. GPS and map data will facilitate route planning and navigation. Drivers will be able to switch their vehicles from a manual mode to an unsupervised mode in which the driver is not required to monitor the driving environment. The data collected will include safety, user experience (UX), traffic flow, and energy efficiency. Volvo is planning to expand the Drive Me program to London, UK and China.

The first participants in the Drive Me program were announced at the 2017 Detroit Auto Show. As of April, 2017, recruiting for the remaining participants had not yet begun.

#### RELEVANT SCIENCE

The XC90s being produced for the Drive Me study will have autonomous features more advanced than those that are commercially available and will permit drivers to hand over the driving tasks to the vehicle for extended periods. However, transferring driving responsibilities to the vehicle's automation will be possible only on digitally mapped roads that have already been driven extensively by Volvo's engineers. While the autonomous features are effective under normal conditions, they may react unpredictably in uncertain or novel situations. Since this is a safety concern for the participants, the advanced features will be restricted to geofenced areas.

Volvo's autonomous features being used in the Drive Me study are described on the Volvo Website:

- Adaptive Cruise Control automatically maintains a safe distance from the vehicle in front based on vehicle speed.
- A 360° Surround View detects obstacles all around the vehicle.

- Lane Keeping Aid steers the vehicle within its designated lane and keeps it on a consistent track.

The Autopilot Interface signals the transfer of control between driver and car. When the automation is driving, the user interface communicates what actions the car is about to take, such as changing lanes or overtaking.

#### WHY IT MATTERS

To a large extent, the success of driverless cars will depend on consumer acceptance of the technology. However, early surveys suggest a majority of the public mistrusts driverless cars. A March, 2016 poll by the American Automobile Association (AAA) reported that 75% of US drivers are "afraid" to ride in a driverless car. This number was confirmed by January, 2017 report released by Deloitte. A poll performed by the University of Michigan's Transportation Research Institute in May, 2016 found that 84% of Americans do not want to ride in a fully autonomous vehicle, and that additional media coverage and awareness of driverless cars was having little influence on consumer acceptance. One potential solution is to give more people a chance to ride in a driverless car. According to separate studies performed by Virginia Tech, AAA and Volkswagen, people become comfortable with driverless cars fairly quickly, when given a chance to ride in one. By giving members of the public a chance to ride in their cars, Volvo will likely improve public trust in its technology, along with getting valuable feedback on its use.

While the Drive Me study will take place in Sweden, the UK, and China, the involvement of the public in the testing of autonomous vehicle technology is relevant to US policy. In the US, the DOT's Federal Automated Vehicle Policy (FAVP; SciPol brief available) instructs manufacturers of autonomous vehicle technology to develop tests and validation methods that ensure the safety of their vehicles. The Drive Me project addresses multiple aspects of this portion of the guidance. According to the draft guidance:

"Tests should demonstrate the performance of the behavioral competencies that the HAV system would be expected to demonstrate during normal operation… To demonstrate the expected performance of an HAV system, test approaches should include a combination of simulation, test track, and on-road testing."

Testing and validation applies to the broad categories of vehicle operating domains (e.g., roadway types, speeds, weather conditions, geographic areas) and the ability of the vehicle to detect and respond to circumstances relevant to driving, as well as the specific areas of data recording and sharing, the human machine interface, post-crash behavior, adherence to (and in some cases deviation from) applicable federal, state and local laws, and system safety, each of which is included in the FAVP's 15-point safety assessment.

#### RELEVANT EXPERTS

Michael Clamann, PhD, CHFP, Senior Research Scientist, Duke Robotics

#### BACKGROUND

The FAVP observes the SAE International (SAE) definitions for levels of automation to define the term "Highly Automated Vehicle." SAE is a global professional association of over 128,000 aerospace, automotive, and commercial-vehicle engineers and technical experts, and is recognized as the world's largest developer of standards for the automotive and aerospace industries. The SAE definitions for automation divide vehicles into six levels ranging according to who (driver or automation) performs different aspects of the driving task:

- SAE Level 0: No automation - the human driver *always* performs *all* parts of the driving task
- SAE Level 1: Driver assistance – vehicle automation can *sometimes* assist the human driver on *some* parts of the driving task
- SAE Level 2: Partial automation – vehicle automation can conduct *some* parts of the driving task, while the human driver is responsible for monitoring the driving environment and performs the rest of the driving task

- SAE Level 3: Conditional automation – vehicle automation can conduct *some* parts of the driving task and monitor *some* the driving environment, but the human driver must broadly monitor the driving environment and be ready to take back control when needed
- SAE Level 4: High automation - vehicle automation can conduct the driving task and monitor the driving environment, and the human need not take back control, but the automated system can operate only in certain environments and under certain conditions
- SAE Level 5: Full automation – vehicle automation *always* performs *all* parts of the driving task

The autonomous vehicle technology implemented in the Drive Me project is an example of SAE Level 4 automation as the vehicle is expected to be capable of performing all aspects of the driving task on the test route, but the driver will navigate the vehicle outside the test route. The test suggests Volvo may be bypassing SAE Level 3 automation for its development efforts. Level 3 automation requires the driver to remain prepared to take control from the vehicle at any time. Granting an autonomous vehicle the ability to warn a driver of an emergency with enough time to assess the situation and respond safely, remains an open, and challenging area of research. Some manufacturers, therefore, are choosing to focus their efforts on Level 4 and 5.

The Volvo XC90s that will be used for the study first became available in September, 2016; the company announced the start of their recruiting efforts at the Detroit auto Show in January 2017.

#### ENDORSEMENTS & OPPOSITION

At present, there have not been any publicly reported reactions to this industry development.

#### RELATED POLICIES

DOT Federal Automated Vehicle Policy: Accelerating the Next Revolution in Roadway Safety (Draft Guidance) (SciPol brief available).

#### ORGANIZATIONS

Primary Organization: Volvo Cars Group

Secondary Organizations:

- Autoliv
- Chalmers University of Technology
- The City of Gothenburg

#### PRIMARY AUTHOR

Michael Clamann, PhD, CHFP

#### EDITOR(S)

Alex Robeson, PhD, Aubrey Incorvaia, MPP

#### RECOMMENDED CITATION

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