ACC in the Loop

Hitachi, Ltd.: Effective ACC Development Using dSPACE Simulator

The Automotive Systems group at Hitachi, Ltd. uses dSPACE hardware-in-the-loop simulators to efficiently develop an Adaptive Cruise Control (ACC) system that controls the distance to the vehicles and traffic ahead. The test environment setup uses a dSPACE Simulator to perform functional verification tests of the ACC system, and significantly reduces the development time and required man-hours.

Mr. Takaki in the Hitachi test laboratory.

Hitachi's Approach to Safety

Hitachi always emphasizes safety. This is why we make a continuous effort to develop various systems that support safe driving.
We have already put the following techniques into practical use: image processing cameras that supplement human vision and are capable of stably recognizing traffic; ACC systems that control the distance to the vehicle ahead by using laser radar or millimeter wave radar; Lane Keep Support (LKS) systems; and pre-crash braking systems.

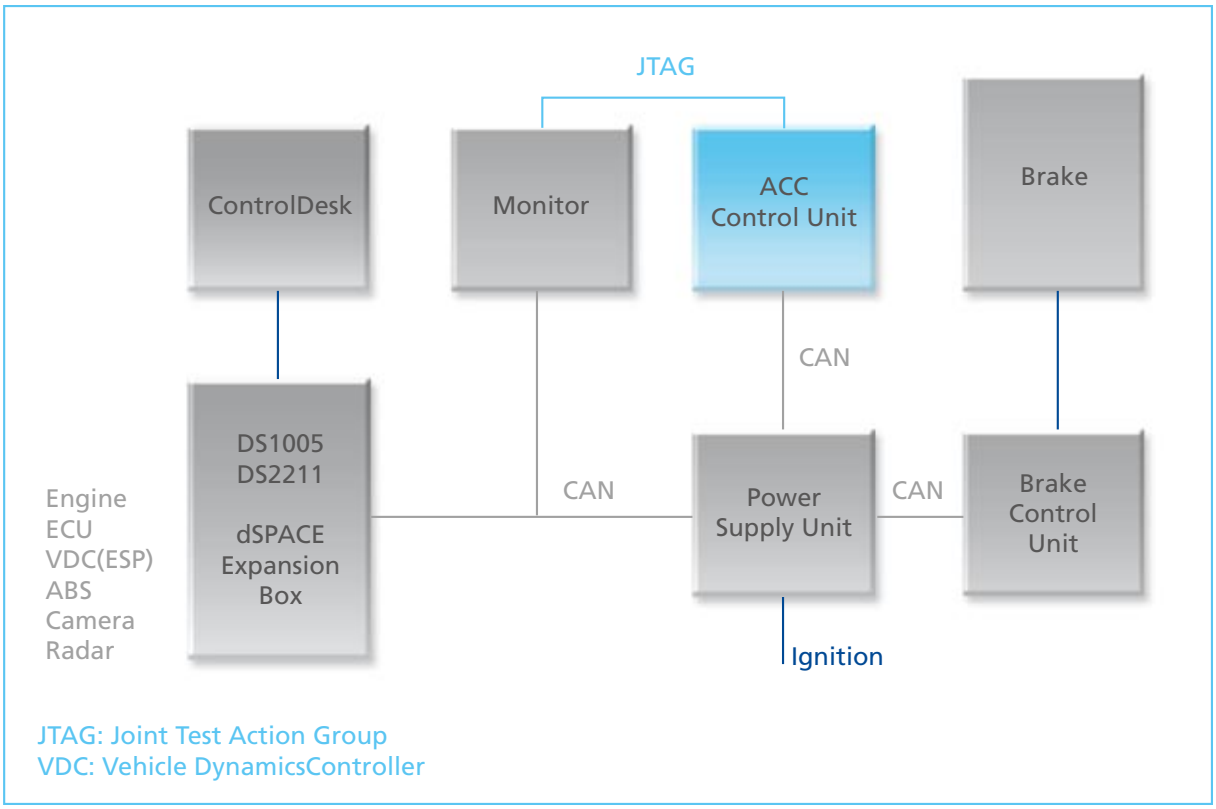
Role of Hardware-in-the-Loop (HIL) Simulation in ACC Development

With the conventional ACC test environment, it took a great amount of time to establish and prepare a development environment because switch boxes and control programs were all made in-house. In addition, every time a change was made to the ACC specifications, numerous efforts were required to update the environment. In a test environment using a hardware-in-the-loop (HIL) simulator, however, it is possible to respond flexibly to changes in test conditions by simulating everything in the software (e.g. camera and radar outputs, vehicles, and surrounding environments). When the conventional test environment was used, the time spent for developing the first generation ACC was about 12 months, whereas the development period of the second generation ACC was about 6 months when the HIL simulator was used. This is a significant time reduction. In addition, the development period for the third-generation ACC based on the know-how from the second generation HIL simulator environment, was reduced to about 3 months. We attained much higher development work efficiency.

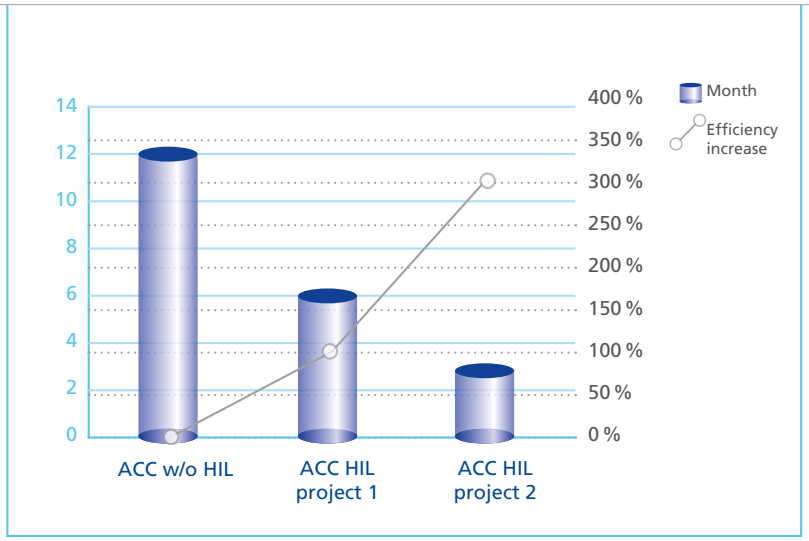
> "I've been using dSPACE products for seven years, and haven't encountered any problems with them."
>
> *Mr. Takaki, Hitachi, Ltd.*

Evaluation of dSPACE Products

The Automotive Systems group has been using dSPACE products, without any problems, for over 7 years



Overview of the test system where the dSPACE HIL simulator, an ACC control unit, and a brake control unit are connected via a CAN network.



Development time reduced from 12 to 3 months by using HIL tests.

"Test environments using dSPACE Simulator reduce the development time significantly, resulting in efficient development."

Mr. Kawakami, Hitachi, Ltd.

now, and highly values the reliability and durability of the products. As usability of the software is high, it is now possible to easily grasp the vehicle movements with the test parameters (inter-vehicular distance, vehicle speeds, etc.).

The Future of ACC Development

ACC systems used to be installed in only a few luxury vehicles. Since then, the number of vehicle models/types equipped with an ACC system has increased. If all the variants of the models/types, which vary according to destination and hardware, are included, testing will have to be performed for all of the several hundreds of ACC variants. With HIL simulation, it is possible to flexibly test such a wide variety of variants, just by changing software models.

ACCs developed at Hitachi, Ltd., which were implemented by many automobile manufacturers, have made a significant contribution to increasing the safety of automobile traffic systems.

Mr. Takaki
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Direct control and visualization of ACC signals in ControlDesk.