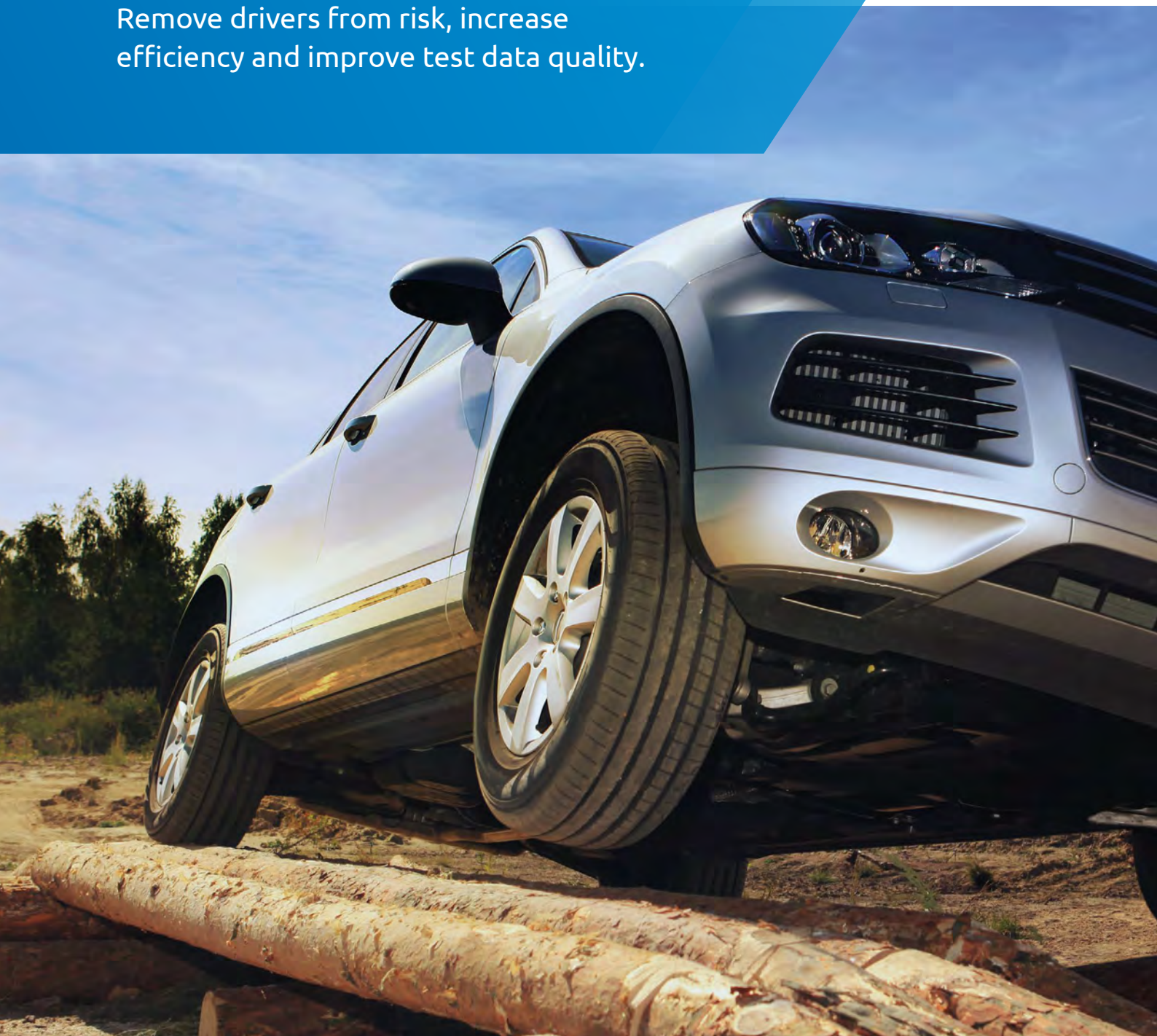
AB DYNAMICS™

Solution Brochure

Driverless Durability and Misuse Testing Solution

Remove drivers from risk, increase efficiency and improve test data quality.



A safer, more efficient approach

The automotive industry has been conducting durability and misuse testing on vehicles for decades. The tests are designed to explore the durability and reliability of vehicles and to understand how they behave in extreme situations.

Traditionally, this testing is carried out by human drivers. These tests can be unpleasant, arduous and sometimes dangerous, with repeated tests occasionally leading to injury. As a result, driving shifts need to be limited to as little as two hours to protect the driver, which lengthens testing schedules and impedes efficiency.

AB Dynamics' driverless solution uses driving robots, software, telemetry and sophisticated controllers to safely conduct these tests, removing the driver from the vehicle. It eliminates risk to the driver, accelerates testing and improves the accuracy and repeatability of test results.

Our experience in delivering driverless testing solutions is unrivalled. We have more than a decade of experience in delivering over 60 turnkey driverless solutions for OEMs, testing houses and autonomous vehicle developers around the world. Plus our driving robots and software have been providing users with accurate and repeatable control in more than 2,000 systems since 1997.

A driverless durability and misuse testing solution is ideal if you need to:

/ Improve health and safety by removing drivers from exposure to stress and injury
/ Increase testing efficiency by sequentially executing identical, pre-programmed tests
/ Improve the quality of test data with greater accuracy, precision and repeatability

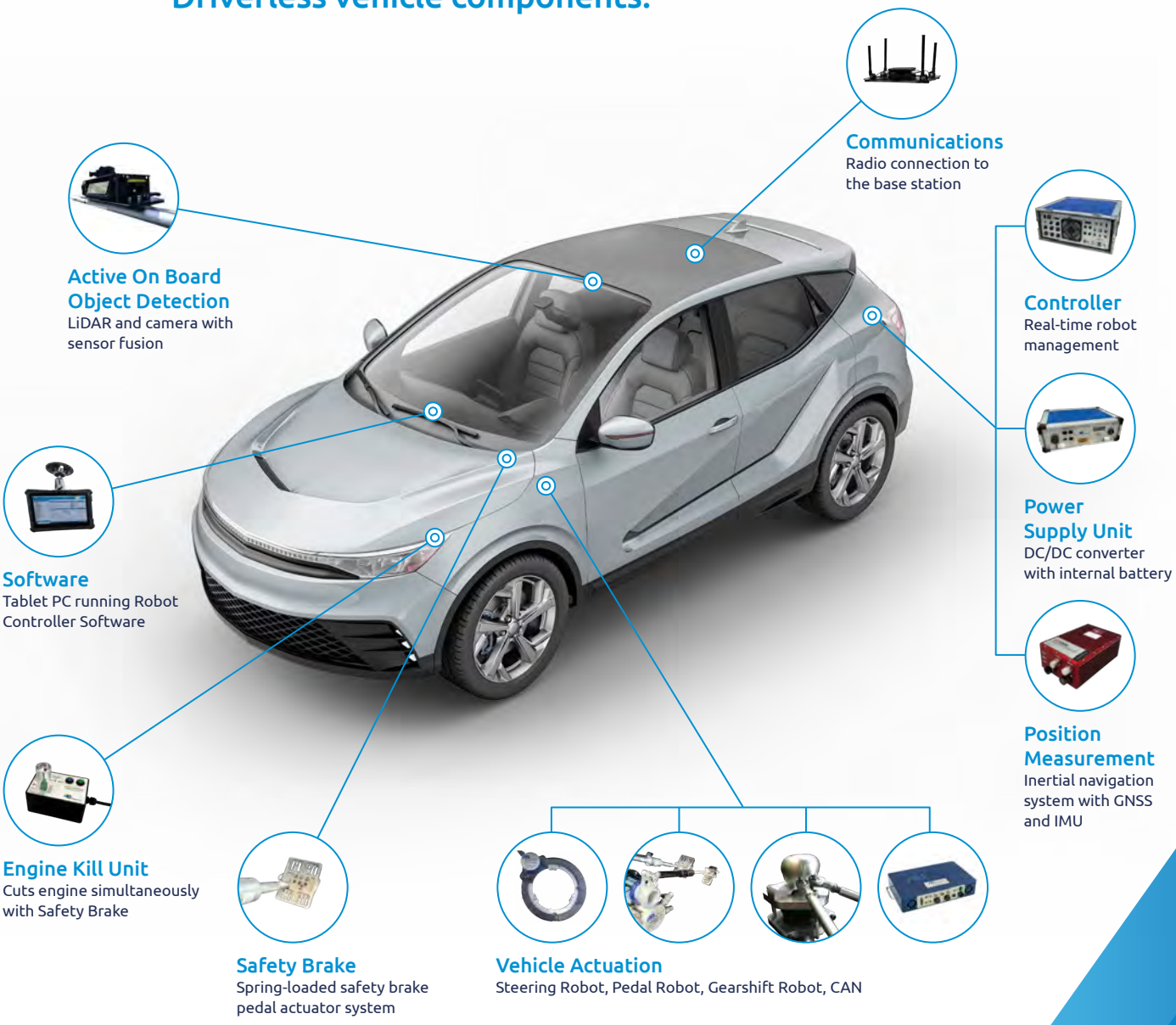
How it works

AB Dynamics' driverless solution is comprised of three key elements: the driverless vehicle, the base station and the communication network. In addition, a LiDAR and camera-based active collision detection system can be optioned to detect and avoid untracked objects on the test track.

Driverless vehicle

Vehicles are made driverless through either mechanical actuation using pedal, steering and gearshift robots, or by-wire using our Flex-0 CAN control system. Both robot actuation and by-wire solutions provide precise control of the vehicle's position, direction and speed.

Driverless vehicle components:

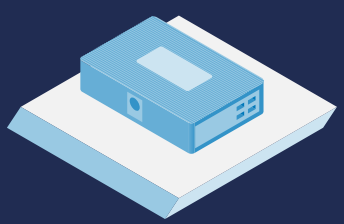


Base station

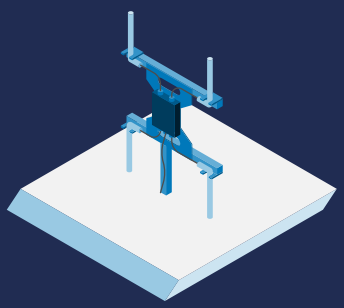
The Base Station is where the operator programmes, manages and controls vehicles using AB Dynamics' easy to use Ground Traffic Control (GTC) software.

Vehicle test routes are created and executed using our Path Following software. It uses real-time feedback from GNSS-corrected motion packs to provide the inputs to the driving robots or Flex-0 to guide the vehicle along the specified path.

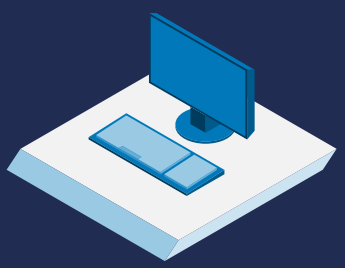
Base station components:



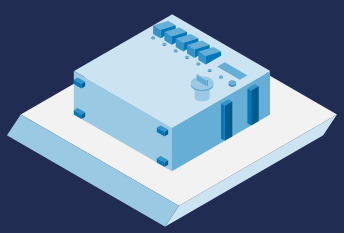
GTC Server
Real-time link with vehicles and track infrastructure



Radio Base Station
Secure high throughput data transfer

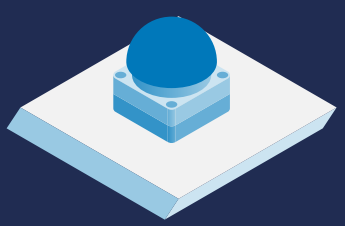


GTC Software
Vehicle monitoring and control with GNSS collision detection



Safety Controller
Safety brake and engine kill system management

Vehicle Control
Remote manual vehicle control



Global Abort
Remote stopping of all managed vehicles

Communication network

The system utilises a high-performance mesh radio network to provide reliable data transfer from vehicle-to-vehicle and vehicle-to-base. Cyber security is ensured through encryption, while the network can be set up with fixed infrastructure or it can use mobile nodes to enable testing anywhere.

On board active object detection

The driverless solution can be upgraded with an active obstacle detection system, utilising LiDAR and camera with sensor fusion. The system will stop the driverless vehicle if its path is blocked, bringing additional benefits:

/ Detection of untracked objects, such as wild animals or vehicle debris preventing the test vehicle from sustaining damage
/ Operation of driverless vehicles over large areas safely, beyond base station line of sight
/ Reduction in operator workload when monitoring multiple driverless vehicles, as each vehicle has increased on-board autonomy, increasing the number of vehicles a team can safely operate

Key features

Quick and simple installation

Installation and set-up of driving robots, power, control and positioning equipment in the test vehicle is quick and simple. A robot solution can be fitted in under two hours, or as little as 30 minutes with the Flex-0, and no permanent modifications to the vehicle are required. The vehicle can be easily driven manually with the driverless equipment in place, so once the equipment is installed it can remain in place until all testing is complete.

Automated testing

Test scenarios are simple to set up and can be downloaded and replayed for future tests – creating a comprehensive library of scenarios to build your test programme around. A single test schedule can include multiple Path Following elements, for example loops around different durability tracks, as well as open loop elements, such as would be used for misuse testing.

Once the schedule is built, the day to day running on the system needs no specialist skills, and a typical test driver can be trained to safely run the robots in a few days. This means that the introduction of robots for durability testing need not require staffing changes.

The test schedules can be fully automated so the operator just needs to choose which one to run and the robots or Flex-0 will do the rest, and even park up once completed. One operator can also safely manage multiple vehicles, as once they are running, the only thing they need to do is make sure the test area remains safe. The driverless vehicles themselves will ensure they are all safely spaced based on pre-set limits. Vehicles on intersecting paths can give way to each other safely, without any need for operator intervention.

Vehicle monitoring

Our solution remotely monitors vehicle health through its OBD sensor port. This means vehicles can be stopped as soon as any warnings are detected, or if low on fuel it can automatically drive to a refuelling area. The onboard Inertial Measurement Unit (IMU) can also be used to monitor accelerations to accurately assess the health of components such as the vehicle's shock absorbers.

At any point, the vehicle can be driven to a safe environment remotely and a test driver can manually drive the car with the equipment still in place to provide a subjective assessment of the vehicle's condition.

Power Sequence Groups

Power Sequence Groups enable you to easily build and automate the execution of complex test sequences, with each test flowing seamlessly into the next. Automatically generated connecting paths ensure the end of one test merges into the beginning of the next test without ever needing to stop the test vehicle, significantly boosting testing efficiency. Groups can combine closed-loop path following or speed control, as well as open-loop steering and pedal tests to cover all test scenarios.

In addition, advanced triggering and monitoring capabilities provide a powerful solution for building complex test campaigns. Every test within a sequence can be configured with a normal exit transition as well as the option of a triggered exit route when a chosen condition is met.

The extensive range of trigger channels available together with programmable logic enable you to build flexible and efficient test campaigns that don't require human input. These include test metrics such as laps of a test sequence, CAN channels receiving vehicle sensor data, and real-time vehicle dynamics data. For example, test vehicles can be programmed to automatically to take an alternative route through a water bath when damper temperatures exceed a selected limit.

Make almost any vehicle driverless

The AB Dynamics driverless system is vehicle agnostic. We have experience with driverless vehicles in a range of industries including passenger cars, motorsport, defence and heavy vehicles.

Benefits

Improved health and safety

Durability and misuse testing is an arduous environment. So much so that driver shifts commonly need to be short to prevent the risk of stress or injury. Removing drivers from the vehicle is the only way to completely protect the health and safety of your team.

Because the driver is safely removed, the shock and vibration levels the vehicle is exposed to can be amplified, through increased speeds or running on more demanding test surfaces. This opens up the possibility of accelerating the lifecycle testing in an attempt to identify premature failures or weaknesses.

Better quality data

Robots are far more accurate, precise and repeatable than any human driver. Shift to shift, day to day, vehicle to vehicle, robot performance will always be consistent. This makes the data collected more valuable to your engineering teams, providing the confidence that variation between results is not down to variable conditions but to the vehicle itself.

Using a driverless solution, customers who have test facilities on different continents are able to perform exactly the same tests. Whether a team in the US or Japan runs the test, you can be confident that variation in results is due to the vehicle, not the driver.

The driverless solution can typically control the vehicle under normal driving conditions to an accuracy of 2 cm, the speed to within 0.5 km/h and steering angle to within 0.5 degrees. This level of precision means robots get the test right, first time. It also enables extreme vehicle manoeuvres to be programmed that simply can't be reliably achieved through human control. For example, sliding the rear of a vehicle into a target.

When validating simulation data, robots will allow those scenarios to be enacted far more accurately, giving better data and higher engineering confidence.

Increased efficiency

Using a driverless solution to conduct durability and misuse testing opens an array of opportunities to increase efficiency and accelerate your testing programmes.

Our easy-to-use software means creating, saving and running test scenarios is simple. It enables you to develop a comprehensive library of tests that can be used to produce a vehicle's test programme and then repeated for different vehicles and across the model range.

Once these tests are setup, powerful sequencing tools enable robot-driven vehicles to sequentially perform the tests and automatically take action when a predetermined event occurs, such as entering a pit bay when the vehicle requires refuelling or recharging.

Efficiency is further enhanced by 24/7 operation without any dips in performance and a single member of the team can manage multiple vehicles.

Safety

The AB Dynamics driverless solution has been designed from the ground-up with safety as a priority. There are multiple layers of safety that have been integrated into the system.

Safety features include:

/ Dual redundant watchdog and monitoring signals give operators complete confidence that they can stop vehicles at any time
/ Fail-safe system stops the vehicle, even in the event of total power loss to the robots
/ Geofence system limits the area where the robots can operate
/ Watchdog signals stop the vehicle if vehicle communication fails
/ Global rule zones allow tight control of critical areas, applying additional restrictions on speed or vehicle movements
/ An encrypted communication system prevents third parties from accessing the network
/ Sensor-based collision detection option
/ On-board real-time diagnostic checking to ensure Path Following and Speed Control are within the configured limits
/ Test speed limits, to guard against user errors
/ Motion pack accuracy is continuously monitored to ensure it is within the limits allowed for vehicle control
/ Multiple remote users can monitor the driverless fleet and any of them can command testing to stop
/ As well as dual redundant brake actuation, the solution has the means to kill the vehicle engine, ensuring the driverless vehicle is made safe

Training and support

We work closely with you to ensure the successful integration of your driverless solutions into your vehicle testing operation so the benefits can be realised quickly. All customers receive training and the user-friendly software interface has been designed to guide test operators through the set-up and running process. We have regional support locations in Europe, Asia and the Americas to support you through implementation and beyond.

About AB Dynamics

When you choose a solution engineered by AB Dynamics, you're benefitting from proven hardware, trusted software, 40 years of knowledge and experience, plus unrivalled service and support. Our range of automotive testing, verification and validation solutions encompass dynamics, suspension and steering characterisation, durability, advanced driver assistance systems and autonomy.

We pride ourselves on delivering solutions that enable the development of safer, more enjoyable, efficient, and eco-friendly vehicles. As a key partner to the global automotive industry, our customers include the top 25 vehicle manufacturers, Tier 1 suppliers, test facilities and autonomous vehicle developers.

As part of the AB Dynamics Group of companies, we offer a wide range of vehicle autonomy, simulation, and testing solutions. As a group, we enable customers to develop and test vehicles in laboratory and virtual environments, validate on the track before finally evaluating vehicles in the real world on public roads.

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