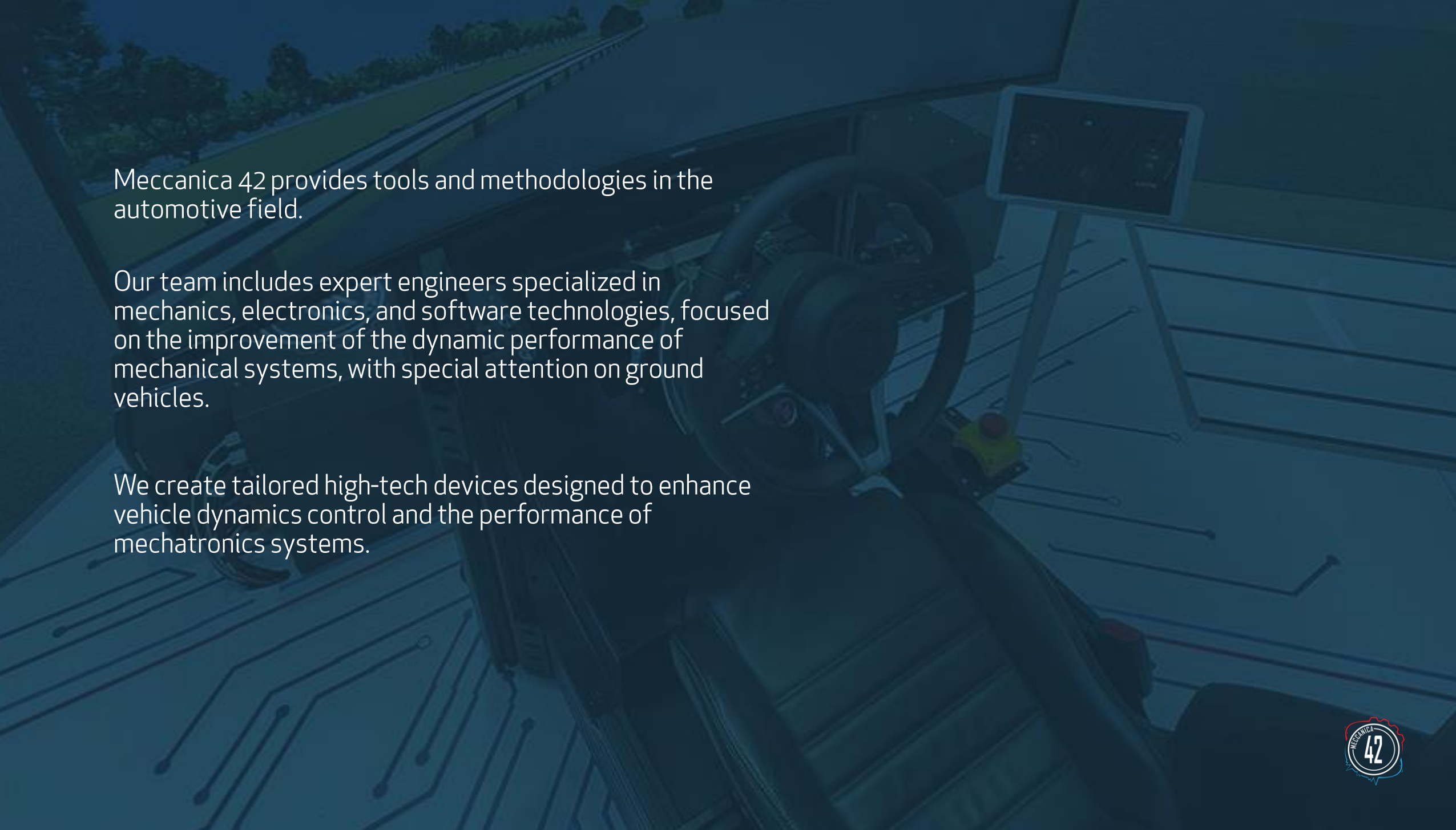
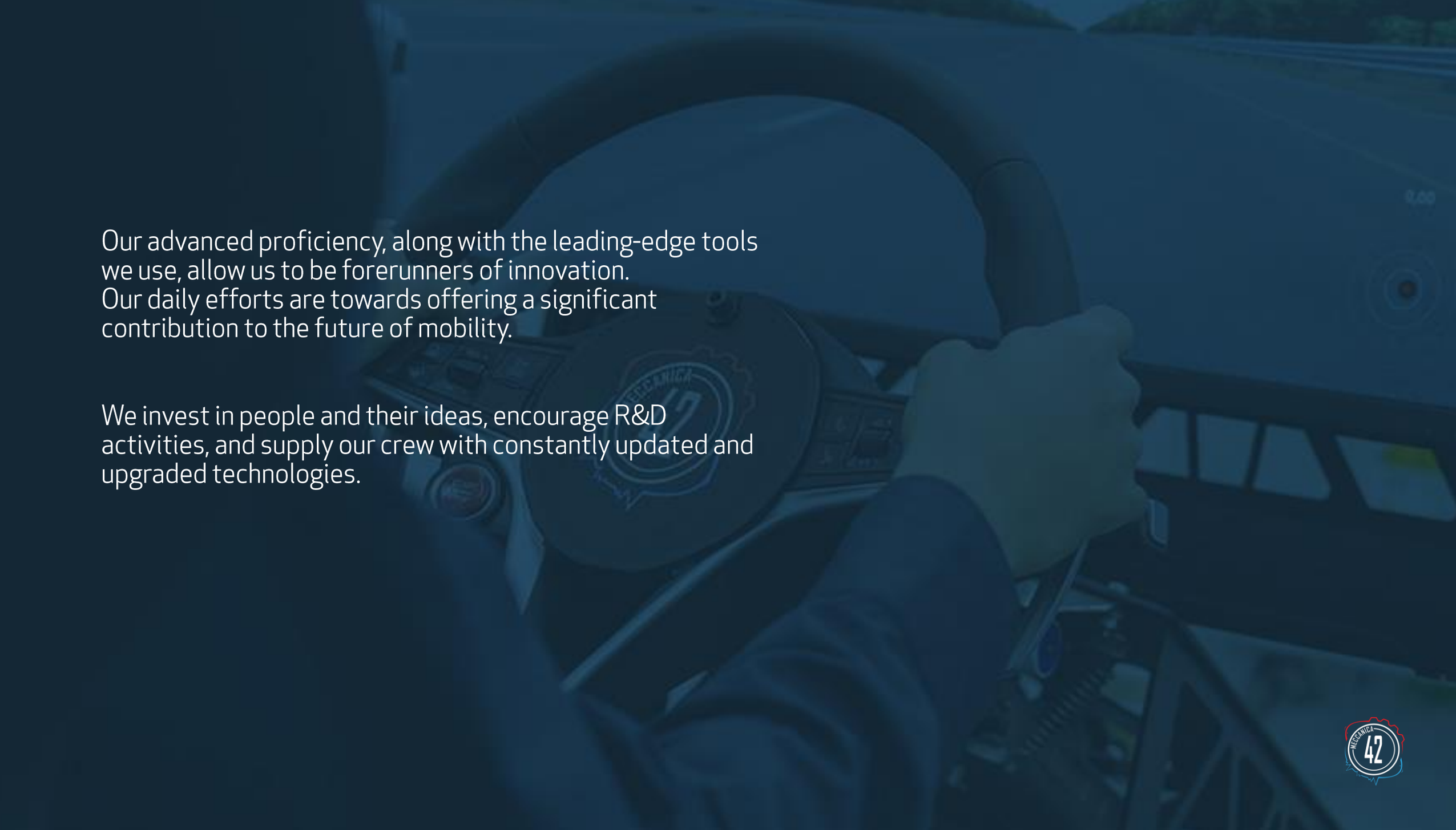
Simulation Station of Meccanica 42



Meccanica 42 provides tools and methodologies in the automotive field.

Our team includes expert engineers specialized in mechanics, electronics, and software technologies, focused on the improvement of the dynamic performance of mechanical systems, with special attention on ground vehicles.

We create tailored high-tech devices designed to enhance vehicle dynamics control and the performance of mechatronics systems.



Our advanced proficiency, along with the leading-edge tools we use, allow us to be forerunners of innovation.
Our daily efforts are towards offering a significant contribution to the future of mobility.

We invest in people and their ideas, encourage R&D activities, and supply our crew with constantly updated and upgraded technologies.

Products

Meccanica 42 provides:

- on board devices that give you the power to interact with traditionally inaccessible systems, by enabling you to design every functional concept on actual vehicles.
- Simulation Station, that interconnects vehicle devices to a virtual simulation environment

Services & Integration

Every device under test has different requirements; hence why in addition to our standardized products, we offer a personalised service tailored to your needs and requests. Our service package includes hardware and assistance from our experienced and competent engineers.

Special projects

It's part of our mission, and it is also one of our core values to be a dynamic company, hence why if you need assistance on building a project from scratch we can be your co-makers.
According to your requirements and working closely with you, we are able to find the perfect solution.

Simulation Station

This tool combines all vehicle devices in a virtual simulation environment.

This innovative system allows engineers to safely test all hardware within the lab safe space.

The Simulation Station is composed of a steering system (EPSiL), a brake system (BrakeiL) and a camera set up (CamiL), however our Simulation Station can be paired with a variety of tools, according to the clients' needs.

EPSiL - Steering System in the Loop

EPSiL allows the real-time testing of complete steering systems indoors.

It is designed to test the interaction between the wheel forces, steering functions and human beings in a controlled environment.

It enables human-driven tests into driving simulators or fully robotized tests as a stand-alone unit.

EPSiL applies the steering links forces respecting the vehicle kinematics, while the driver handles the steering wheel and the EPS interacts with the virtual vehicle.

EPSiL - Steering System in the Loop

Our test bench enables you to speed up your development processes up to 1 million km per year.

The test rig is suitable to develop, tune and validate steering functions in:

- Vehicle dynamics
- Assistance torque
- Steering feel
- ADAS/AD
- FUSA/SOTIF

Highlights EPSiL

- Real time testing of any steering function
- Accurate reproduction of the road wheel forces on the steering links
- Actual feedback at the driver's hands
- Can be integrated in any real-time driving simulators

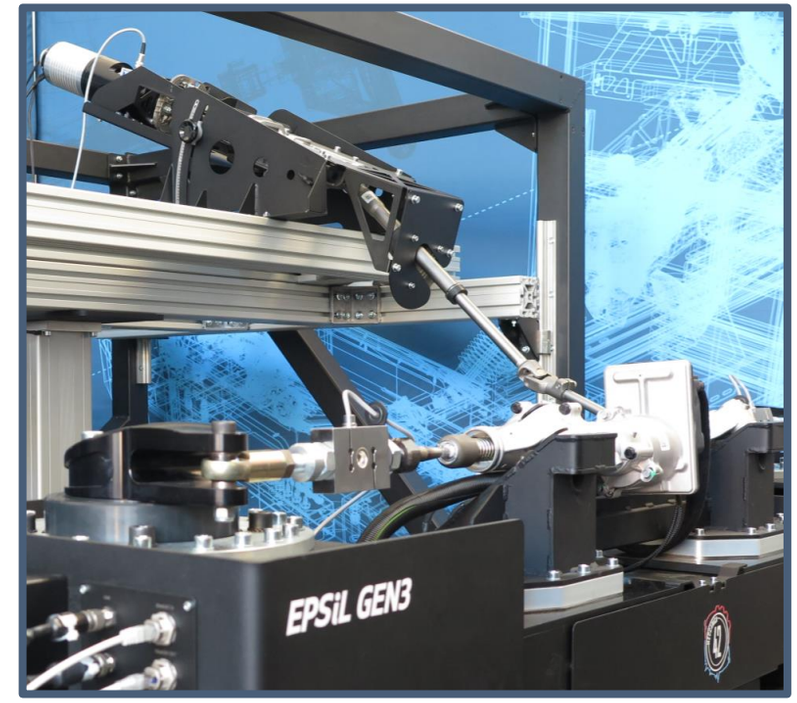
Technical Feature	Technical Specification
Possible steering systems under test	All EPAS, Steer by Wire, Motorsport, etc.
Force on each steering link	Standard sizes: » EPSiL10 › 10000 N peak › 3400 N rms » EPSiL20 › 20000 N peak › 4030 N rms
Bandwidth	>14 Hz (for standard sizes)
Sensors accuracy	0.2% FS
Communication latency	<3ms
Safety system	Multisensor-based STO
Plane of motion	Standard configuration: XY or YZ
Overall dimension standard size (X-Y-Z)	675 – 2300 – 657mm
Adjustment of outer steering link distance in Y direction	±120 mm (std)
Adjustment range of the steering gear in Z direction	±30 mm (std)
Adjustment range of the steering gear in X direction	+20/-30 mm (std)
Possibility to use in a dynamic simulator	Optional
Possibility to robotize the steering wheel	Optional
Possibility of integration with TA-FA system	
Max dynamic torque of the steering robot (opt)	43 Nm
Communication protocol with the real time machine	Ethercat, CAN, Flexray, other.

Virtual Column

It unveils the potential available by coupling a Hardware in the Loop steering bench to a driving simulator using a feedback actuator and a torque actuator remotely connected in real-time.

The proposed architecture allows to not increase the payload of the dynamic simulator motion base connecting in real time a remotized HiL station with a Feedback unit installed into the cockpit.

The combination of EPSiL and TAFA test bench architecture allows all capabilities of the state-of-the-art static steering test bench to be fully replicated to a remotized simulator.



Technical Feature	Technical Specification
Possible steering systems under test	All EPAS, Motorsport, etc.
Torque on steering actuators	› 62.1 Nm peak › 10 Nm rms
Bandwidth of the remoted closed loop	> 5 Hz
Steering actuators torque sensor accuracy	0.5% FS
Adjustable frame	optional
Communication latency	<3ms
Safety system	Multisensor-based STO
Communication protocol with the real time machine	Ethercat, CAN, Flexray, other.

FS – Feedback System

Technical Feature	Technical Specification
Possible steering systems under test	All EPAS, Motorsport, etc.
Torque on steering actuators	› 62.1 Nm peak › 10 Nm rms
Bandwidth of the remoted closed loop	>5 Hz
Steering actuators torque sensor accuracy	0.5% FS
Adjustable frame	optional
Communication latency	<3ms
Safety system	Multisensor-based STO
Communication protocol with the real time machine	Ethercat, CAN, Flexray, other.

Highlights FS

Technical Feature	Technical Specification
Possible use case	Model in the Loop Remoted hardware in the Loop
Torque on steering actuators	› 62.1 Nm peak › 10 Nm rms
Bandwidth	> 20 Hz
Steering actuators torque sensor accuracy	0.5% FS
Adjustable scaffolding	optional
Communication latency	<3ms
Safety system	Multisensor-based STO
Communication protocol with the real time machine	Ethercat, CAN, Flexray, other.

Case study: EPSiL on DiM

Real-time connected

Torque Actuator

Driver Steering angle and torque reproduction

DiM

Driver motion platform

Feedback Actuator

Steering wheel feedback

EPSiL GEN3

Steering system hardware in the loop test bench

BrakeiL - Brake System in the Loop

BrakeiL is a real-time rig for testing complete brake systems, including (depending on the vehicle under test):

- Brake pedal
- Brake booster (pneumatic, electric, electromechanical, etc.)
- Master cylinder
- ESC module
- One-box brake system
- Hoses, callipers, pads, and discs.

The brake pressure is directly built-up by the master cylinder and all the braking functions (ABS, ESC, etc.) are physically performed by the devices under test. The DUTs receive the raw wheels speed signals from the M42 Wheel Speed Sensor Emulator (WSE) and the communication with the virtual vehicle is over the EtherCAT protocol. The simulation loop is closed on the brake pressure, measured on the four calipers.

BrakeiL - Brake System in the Loop

BrakeiL enables human-driven tests into driving simulators or fully robotized tests as a stand-alone unit and it is suitable to develop, tune and validate braking functions in:

- Vehicle dynamics
- ABS/ESC
- Brake pedal feel
- ADAS/AD
- FUSA/SOTIF
- And more…

Highlights BrakeiL

- Real-time testing of any braking function
- Accurate reproduction of the wheel speed signals
- Actual feedback at the driver's foot
- Can be integrated in any real-time driving simulators

Technical Feature	Technical Specification
Possible braking systems under test	ABS, ESC, One-Box, BBW, etc.
Sensors accuracy	0.5% FS
Communication latency	<3ms
Safety system	Multisensor-based STO
Possibility to use in a dynamic simulator	Optional
Possibility to robotize the brake pedal	Optional
Max force of the robotized pedal	1200 N (std)
Max linear velocity of the robotized pedal	0.7 m/s (std)
Max linear travel of the robotized pedal	200 mm (std)
Communication protocol with the real time machine	Ethercat, CAN, Flexray, other.

CamiL – Camera in the Loop

CamiL allows the introduction of the camera-based vehicle functions into a driving simulator laboratory.

With its integration with EPSiL and BrakiL, it enables the real-time testing of all the strategies implemented in the ECU.

CamiL shows a virtual scenario to the front camera through a system of lenses and monitors, and virtual sensors complete the set of sensing devices to perform all ADAS functionalities.

CamiL – Camera in the Loop

The test rig is suitable to develop, tune and validate steering functions in:

- Vehicle dynamics
- ABS/ESC
- ADAS/AD
- FUSA/SOTIF
- And more

Highlights CamiL

- Real-time testing of any camera function (e.g. Lane Keeping, AEB, ACC, etc)
- Accurate reproduction of the camera field of view
- Fully adjustable camera position
- Can be integrated in any real-time driving simulators

Technical Feature	Technical Specification
Type of testable camera	Mono
Camera position adjustment range (standard configuration)	X: 0 / + 620 mm (from the screen) Y: + /- 220 mmZ: 280 mm Z: ±140 mm from the screen center Pitch: ± 45°
Communication protocol with the real time machine	CAN, Flexray, other.
Overall dimension (standard configuration)	X: 920mm Y: 660mm Z: 550mm

Wheel Speed Emulator

WSE introduces the raw signals of up to four wheel speed sensor into HIL simulations.

Protocols available	DF11s, DF11i, DF11v
Supply Voltage	12V
Output current levels	7-14-28 mA
Communication	EtherCAT or CAN
Communication rate	up to 100Mbps (EtcherCAT) up to 1Mbps (CAN)
Features:	• tunable wheel Parameters (Radius, pole number) • user defined data protocol bits • switching protocol • AK protocol

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