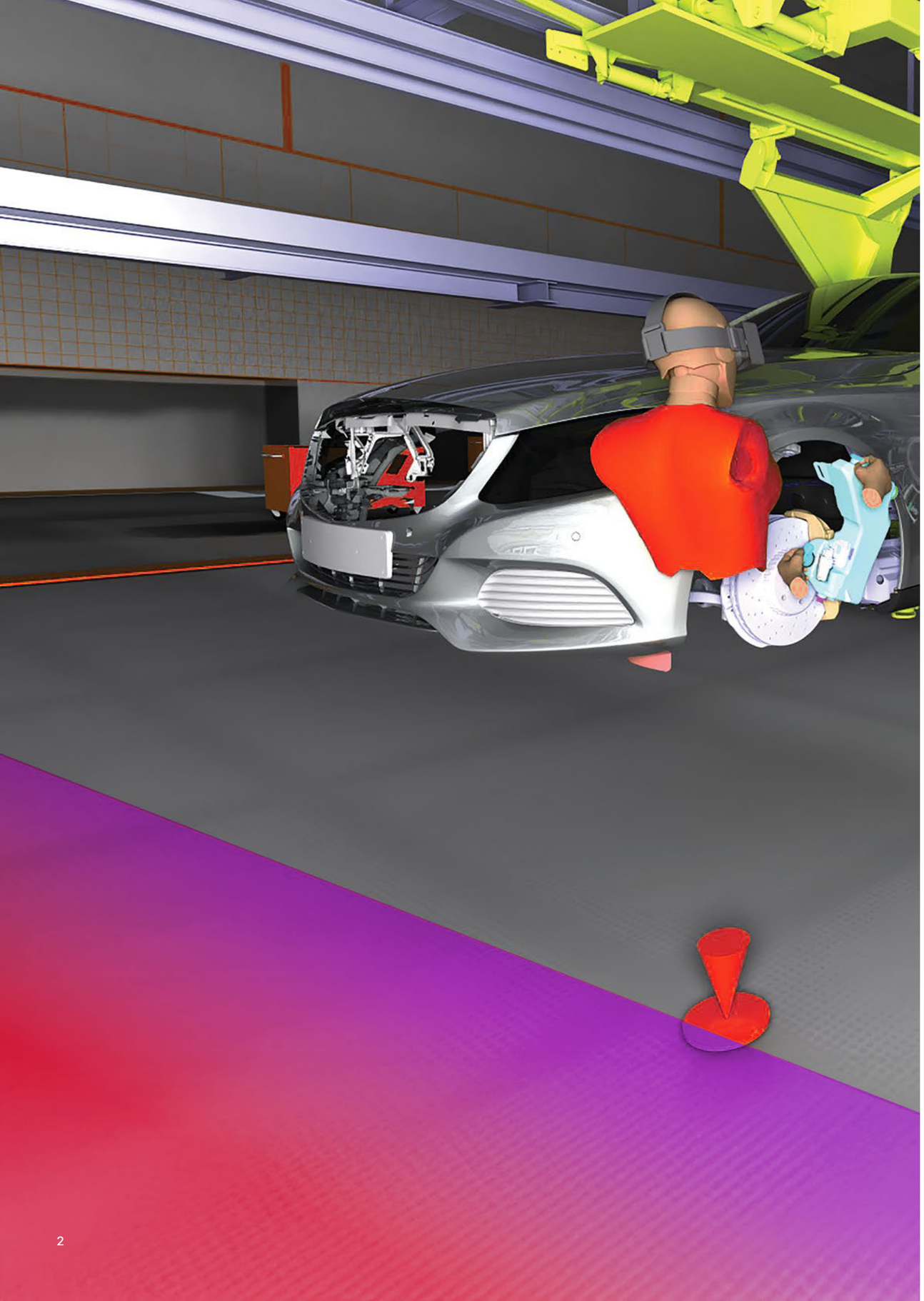
KEYSIGHT

Experience Your Future Products and Processes. Through the World of Immersive Virtual Reality.



Executive Overview

In the race to bring electric, autonomous and connected vehicles to the marketplace, OEMs are facing a difficult puzzle: increasing the efficiency of the existing transportation paradigm and getting their next-generation concepts to market faster. Reduced emissions, new energy sources, and emerging paradigms for mobility drive new engineering decisions that could introduce risks for the people who operate, build, and maintain those products.

The advent of electric vehicles challenges previous assumptions in automotive design and requires new lightweight materials and even new manufacturing and assembly solutions. What worked for more than a century can no longer sustain the major industry shift. To accelerate the development of electric vehicles, enterprises are leaning toward digital transformation and virtual prototyping.

Unfortunately, human interactions with products in key processes, like assembly or maintenance, are often left until later in the development process when physical mock-ups and operable prototypes are available.

Automotive OEMs understand they must leverage digital solutions to accelerate the delivery of innovative automobiles, keep costs down, and avoid the late discovery of inefficiencies. OEMs like **FCA, Volvo GTT, Volkswagen Brazil,** and **Toyota** - and their extended enterprises - rely on Virtual Reality software to power collaborative virtual workflows so that **teams can experience physical interactions with yet-tobe-realized automotive designs without waiting for physical prototypes or requiring traveling to a common site.**

How does VR software allow the connected enterprise to immersively visualize their future products and components, analyze product integration, and synthesize human-centric processes to advance their product development timelines?

Let’s take a look at some concrete examples from leading automotive companies who have been relying on Keysight's Human Workflow Software (IC.IDO): What are the key enabling functionalities that you need to facilitate a seamless mix of virtual objects with your own body and surroundings to push your engineering workflows by months ahead of production?

Orchestrating Work Across the Supply Chain using Collaborative Workflows

At various milestones throughout product development, **cross-functional workgroups,** or integrated product teams (IPT), converge at a common location to **review product designs, check on engineering progress, and validate decisions** made governing the proposed product; do your designs create blind spots for operators? Will different types of operators be able to reach the controls or replace parts? How easy will it be for your operator to access what they need? —all while relying on the availability of a physical prototype or mock-up.

As sustainability remains the focus for today's automotive manufacturers, developments around electric vehicles (EV), battery-powered electric vehicles (BEV), hybrid electric vehicles, and plug-in hybrid electric vehicles (PHEV) are bringing about new challenges for maintenance and service. Extending product and battery life and making sure maintenance and servicing operations will be safe and productive have become a priority for automotive OEMs.

With the shifting economies of remote or local manufacturing and engineering and the ongoing digital transformation of the enterprises competing in that field, accessibility or even the existence of physical prototypes or mock-ups is challenged. If an OEM wants to review assembly process plans with proposed manufacturing sites, highlight the operation/ maintenance/repair of supplied tooling, or integrate tier suppliers' components or subsystems into the vehicle, they rely on computeraided design tools, digital mock-ups, and deterministic simulations of characteristics like durability, performance, or materials selection for manufacturability and structural performance. But when it comes to whether people will be able to build, then operate, ride in/on, and service upcoming vehicles, validation of those decisions are much too often delayed until a physical example is constructed - constructing a mock-up can be a risky business.

Getting together, virtually

Collaboration in Keysight's Human Workflow Software (IC.IDO) challenges the constraints of space and time to enable integrated product teams to experience, together or independently, their proposed products in the context of human-performed product interactions and human-centric processes, such as automotive build and maintenance. Without having to wait for the availability of constructed mock-ups, fabrication of pre-production prototypes, or travel of stakeholders, Keysight's Human Workflow Software (IC.IDO) subscribers can collaborate amongst themselves. Teams can virtually transport themselves to a common virtual environment with their digital products, whether they are remotely distributed, co-located, or in a hybrid working environment—joining each other in a virtual workspace with their digital product concepts and participating interactively in process validations, such as assembly or service operations.

A Real-Scale, Real-Time Immersive Experience Integrating Realistic Physics

Computer-aided engineering (CAE) tools, digital mock-up (DMU) documentation solutions, and predictive analytics do little to anticipate how individuals will perform when faced with new human-centric manufacturing tasks, service procedures, or operations.

Until people can experience what it feels like to build & maintain a yet-to-be-produced vehicle we cannot truly know if a product design is truly “feasible”, let alone cost-effective, safe, or realistic to achieve. Virtual Reality powered process and product reviews as achieved with Keysight's Human Workflow Software (IC.IDO) provides immersed participants the experience of being present with a new product, performing human-centric procedures like installing sub-assemblies during manufacturing build, or replacing components to maintain during service, or conducting human-machine interactions in operation.

With real-time physics, Keysight's Human Workflow Software (IC.IDO) offers true-to-life experiences in virtuality.

- Does a component fit in the assembly without colliding with adjacent components or assembly cells?
- Can operators manipulate tooling without damaging the product or injuring themselves?
- Is a proposed cable harness long enough to be installed but not too long that it abrades during operation?
- Will service technicians be able to work around hydraulics or pneumatics hoses without additional removal and replacement?
- Is the existing tooling useful for working with the new concept vehicle, or will new assist devices be required, and will they fit well the existing infrastructure?

These questions risk remaining unanswered until construction of the new vehicle begins in earnest when it is too late to cost-effectively mitigate or resolve any conflicts. During Keysight's Human Workflow Software (IC.IDO) review, digital design data easily inform these questions virtually, with minimal effort or non-value-added data manipulation or coding.

Through physically realistic human experiences with first- or few-of-a-kind products, product development accelerates by illuminating risk if a product feels impractical to build, unsafe to operate, or impossible to maintain for the people who will do so. Industry need not rely on the methods or assumptions of the past, instead Integrated Product Teams (IPT) gain experience with their products in the context of their planned process to inform engineering decisions, weeks, months, and potentially years in advance.

- ✓ **Avoid finding errors late**
- ✓ **Anticipate inefficiencies**
- ✓ **Gain experience virtually, before operations start**

CASE STUDY

Immersively Validating Human-Centric Engineering Processes to Radically Accelerate Development

Validate Product Integration

How do you know your product is properly designed for assembly, maintenance/servicing, and perations? Using Keysight's Human Workflow Software (IC.IDO) enables OEMs like GM to speed up product development. Teams in charge of Product Engineering use it to validate their product integration strategies early on so they can define their designs agilely, fully digitally, with minimum impact on cost and delays.

Our Virtual Reality simulation software supports the digital evaluation of packaging, clearances and space claim, mechanism design, and interaction, whether for the product in operation or to anticipate issues and bottlenecks for assembly, maintenance, and servicing operations. Thanks to realistic physics, engineers simulate the behavior of wiring, cabling, and hoses, in real-scale and in real-time, empowering teams to discover issues that can arise from tangling, binding, or pinching of hoses and wires, to avoid interference, collision, or abrasion in operation.

Validate Assembly Processes

How can you evaluate different assembly scenarios early enough to accelerate the start of production? Plan your assembly operations early and safely, without requiring any physical mock-up. Keysight’s digital human models (or manikins) representing the anthropometry of your choice will let you evaluate ergonomics, operator visibility, reachability, and accessibility to ensure safe and efficient assembly processes, well ahead of production.

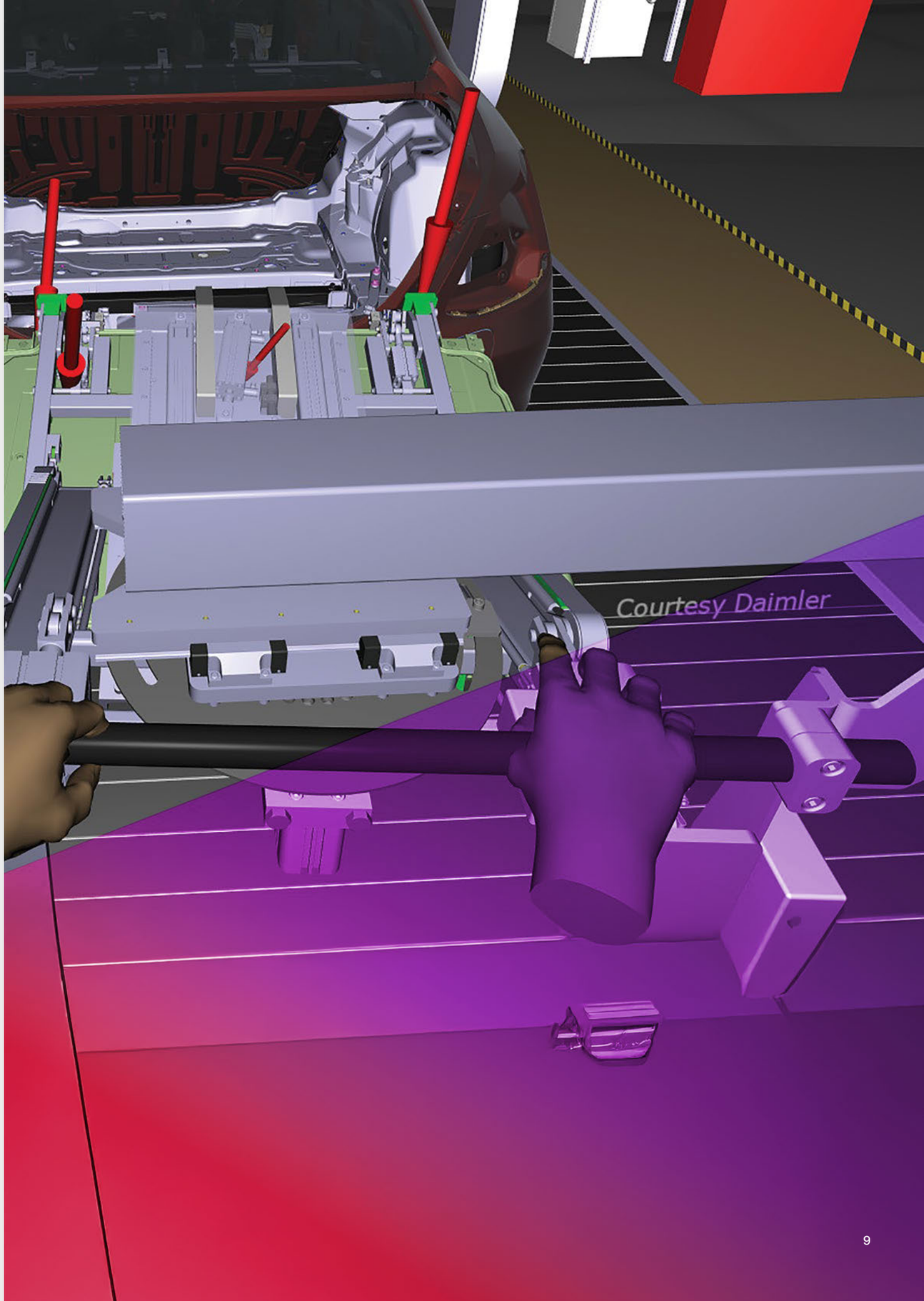
Keysight's Human Workflow Software (IC.IDO) offers realistic physics immersed in a virtual world enabling leading automotive OEMs and their suppliers to validate tooling early and with confidence. They anticipate assembly cell layout and optimization and make sure they reach their deadlines for the start of production and ramp-up phases.

Getting together, virtually

How can manufacturing engineers realistically evaluate their maintenance processes before products are manufactured? When will they find out if an operation is difficult or dangerous to perform as designed?

Using Keysight's Human Workflow Software (IC.IDO) solution enables automotive OEMs to evaluate and validate maintenance processes well ahead of production when problems are less costly to correct. The immersive, real-time, real-scale experience gained using Keysight's Human Workflow Software (IC.IDO) helps manufacturers integrate human interactions as early as possible to achieve maximum process efficiency.

For Maintenance, Repair and Overhaul (MRO) companies or OEMs providing on-site repair, Keysight's Human Workflow Software (IC.IDO) helps prepare maintenance interventions taking account of local constraints, helping them define safe and efficient ad-hoc processes.



Bringing Your Digital Thread to Life

Whether it’s for cost, quality, lead time, or flexibility reasons, the integration stakeholders in the automotive industry are getting more complex by the day. More suppliers, more stakeholders, more risk of miscommunications, misalignment, and inefficiencies impacting the product throughout its entire lifecycle, from design to real-world operations.

To face this challenge, and to gain efficiency, automotive companies are striving to build their very own Digital Thread, allowing them to follow a product through its various digital incarnations of data, from stakeholder to stakeholder, downstream throughout its lifecycle – and back upstream to deliver important feedback to engineering.

The primary goal of a digital thread is to help in making key engineering decisions at the right time. It’s also to increase the visibility to be able to streamline transformations from product design to manufacturing planning, empowering companies to deliver unified change management, working simultaneously and concurrently across product and manufacturing engineering.

At Keysight, we work with a rich ecosystem of partners: software vendors like PTC, hardware vendors like NVIDIA, HTC VIVE, and Varjo, not to mention academics and R&D leaders to make the Digital Thread a reality. As an example, Keysight's Human Workflow Software (IC.IDO) can be fully integrated to PTC Windchill workflows for virtual assembly process validation in assembly lines so that manufacturing process planners can test assumptions months before the start of production. This way, design engineering and R&D can gain virtual experience on the shop floor and improve best practices over time.

Keysight's Human Workflow Software (IC.IDO) brings together all stakeholders to collaborate efficiently on one virtual prototype throughout the full product lifecycle.

Enable the Developement of Innovative Automotive Products with a Human-Centric Framework

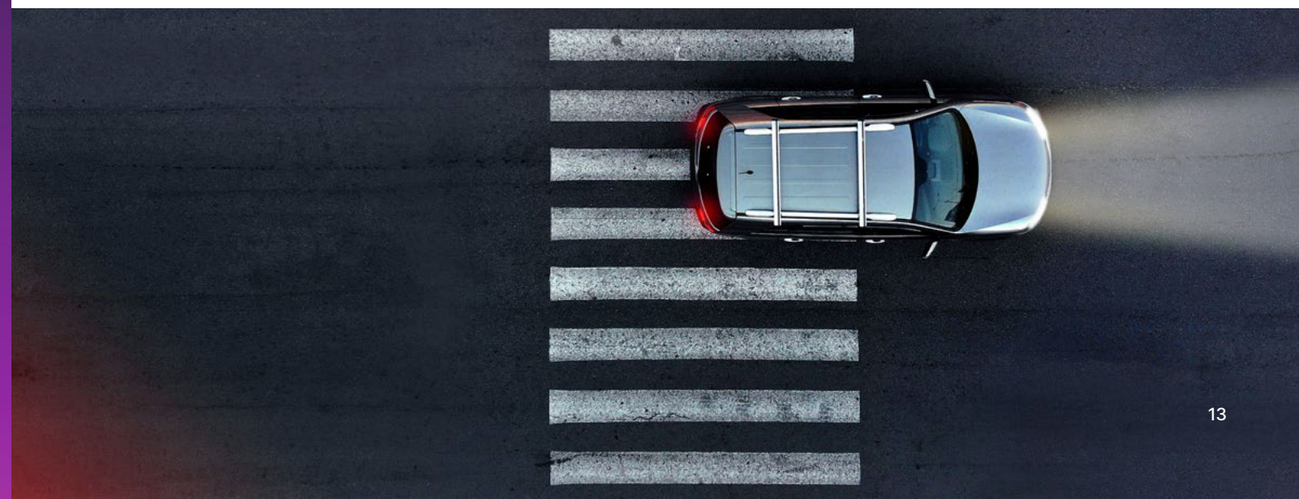
Thanks for taking the time to learn about how automotive industry leaders leverage our industrial grade Virtual Reality software Keysight's Human Workflow Software (IC.IDO). All this is not about us being right but rather about our customers getting it right.

General Motors, Volkswagen Group, Toyota, FCA, VW, and more use Keysight's Human Workflow Software (IC.IDO) to collaborate virtually, and remotely — yet in a physically realistic environment — to experience human-centric operations intuitively, early, and safely, making the right decisions at the right time.

What elevates us and keeps us traveling this journey with you is the common purpose we share: enabling sustainable, safe, and reliable ground mobility.

How about experiencing our Keysight's Human Workflow Software (IC.IDO) for yourself through an immersive product demonstration?

We'll be happy to answer all the questions you may have and show you the value that VR can bring to your company.



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.