



Precision in the virtual world: MAN using the CAVE

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New MAN trucks and buses take shape in the "Cave Automatic Virtual Environment" (CAVE) long before the first physical prototype is built.

- **3D test lab cuts development lead times and optimises the production process**
- **Enables as many as 50% of all deviations to be eliminated prior to the first physical prototype**
- **Provides real-time connectivity for all MAN sites**
- **Head-mounted displays to simulate physical stresses by a full-body tracking system**

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When developing new models, MAN Truck & Bus produces virtual prototypes in a three-dimensional lab so as to detect possible faults well before the start of production. It is all made possible by the "Cave Automatic Virtual Environment" (CAVE), a 46 square metre high-tech creative design facility at the MAN site in Munich. Its five high-performance computers incorporate high-end graphics cards, infrared cameras and stereo projectors featuring 2K image resolution for four large screens.

Around a year before the start of the actual build, the CAVE enables involved persons to move around an exact virtual mock-up of the new truck or bus model using a 3D headset and controller, and thereby clear up some key questions at an early stage in the process: Are all the component units optimally accessible? Does the product or the manufacturing process need to be adapted in any way?

"The advantage of Virtual Reality is that it saves us time, material, and a lot of money," comments MAN advance development and prototyping engineer Martin Raichl. The CAVE also enables MAN to master a

MAN Truck & Bus is one of Europe's leading commercial vehicle manufacturers and transport solution providers, with an annual revenue of some 10 billion euros (2017). The company's product portfolio includes vans, trucks, buses/coaches and diesel and gas engines along with services related to passenger and cargo transport. MAN Truck & Bus is a company of Volkswagen Truck & Bus AG, soon transforming into TRATON AG, and employs more than 36,000 people worldwide.



challenge posed by the modular kit system and by the range of different commercial vehicle models it produces: a bracket might fit perfectly in the MAN Lion's Coach, for example, but need adapting for installation in service bus models. Advance 3D buildability testing enables CAVE staff to identify any potential conflicts in good time.

Virtuality on the march

A joint undertaking by MAN's Production, Development and Logistics functions, the CAVE's investment cost of around 500,000 euros was quickly amortised, considering the deviations which the virtual prototypes identify and therefore prevent from being built into the real vehicles: as many as 50 percent of all potential deviations are identified in the CAVE, meaning they do not lead to costs in the subsequent production process.

And the CAVE's success is being replicated across the commercial vehicle manufacturer's operations: other MAN sites in Nuremberg (Germany), Steyr (Austria), Ankara (Turkey) and Starachowice (Poland) are now also employing virtual labs. Real-time connectivity among the various MAN CAVEs enables colleagues to collaborate on the same virtual models simultaneously across national borders.

The technology itself is also being continually refined. Recently MAN's engineers began using head-mounted displays (Virtual Reality headsets) in the CAVE as a way to experience their vehicle designs even more accurately and realistically. In future they are looking to introduce full-body tracking, in order to even simulate the physical stresses such as a technician might undergo when installing an exhaust silencer for example.