

## PRESS KIT

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## Ibeo Automotive – from technology pioneer to the world's leading developer of automotive LiDAR systems

When the mechanical engineer Dr. Ulrich Lages conducted his research on a system for avoiding vehicle collisions in the mid-1990s, nobody suspected that this dissertation would lay the foundation for becoming one of the world's leading companies in the development of automotive laser scanners. Self-driving, self-propelled, and, of course, self-braking vehicles were considered by many media and even by professionals as visions of an indefinite future just over two decades ago — as far removed from the mass market as Mars for manned space travel. Just a few years later, the vision of the future became reality. In the first decade of the new millennium, assistance systems made driving a car more comfortable and safer in the upper class, and soon afterwards also in the mid and compact classes. For example, they warned of approaching vehicles, initiated emergency braking, and automatically parked the car in tight parking spaces. Not only that: Individual mobility has long been automated in various stages, beyond pure assistance functions. Projects turned from science fiction to the functioning prototypes of the automotive industry.

### **A 3-D LiDAR system not only detects the bridge, but also how tall and wide it is**

This development is made possible not only by ever-faster and more intelligent systems for data processing, but above all through the “sensory organs” of self-thinking and self-steering vehicles. Because without radar sensors, GPS, cameras, and laser-based systems, modern cars would be blind and deaf. Ulrich Lages recognized this early, and persistently optimized his laser scanner technology, short LiDAR (Light Detection And Ranging). From student research grew a realization: LiDAR technology has significant advantages over conventional radar and camera systems. “A LiDAR system offers a much higher resolution, and can therefore draw a much more accurate picture of the environment,” explains Lages. This realization ultimately sparked the idea for founding a company. As early as 1998, Lages founded Ibeo Automobile Sensor GmbH, which later became Ibeo Automotive Systems GmbH, and is now focusing its fast-growing team of experts on further developing the

technology, integrating it into different vehicles, and linking it to the other “sensory organs” of modern cars.

The company is involved in over 50 patents, making Ibeo one of the world's leading developers helping to shape the future of autonomous driving. The technical principle behind the LiDAR technology allows a much higher precision than, for example, radar. In contrast, LiDAR does not work with radio waves, but with light in the form of lasers: The LiDAR sensor emits a very short laser pulse. If this hits an object — such as another car — the laser pulse is reflected, and the light’s travel time determines the respective distance of the object, its position, and ultimately its shape — and a perfect image of the environment is created. Depending on the brightness of the object and the current weather conditions, this works up to a distance of 200 meters (656 ft.). Multiple LiDAR sensors in combination allow for a complete 360-degree view. “Modern 3-D LiDAR systems not only detect a bridge, but also how tall and wide it is,” states Michael Kiehn, Director of Sensor Development.

## 20 years of experience in the fusion of software and hardware

“Autonomous driving is not possible without the many benefits of LiDAR. However, we do not see our sensors as being in competition with other technologies such as radar and camera technology, but rather as a technical component to ultimately deliver perfect results within a network of these systems,” says Michael Köhler, Director of System Development. “Our expertise lies in the fusion of different technologies and the development of different interfaces between each other and the vehicle.” Not an easy task, because the various vehicle, system, and component manufacturers use very different data structures. “Ensuring that the different components speak a certain language, and that it is also understood by the vehicle, is probably one of the main tasks of our engineers,” adds Mario Brumm, Director of Operations. “With 20 years of experience, we have been able to develop a deep understanding of this combination of software and hardware. As a pioneer, we started early and understand both the technology and the market.”

## Rapid company growth and a partnership with ZF Friedrichshafen AG

Autonomous driving is now one of the megatrends in mobility, alongside shared mobility and electric vehicles. Accordingly, the company is developing rapidly, and Lages's foresight is paying off. From 2016 to May 2019, the number of employees in the Hamburg company headquarters increased sevenfold to around 350; and in 2017, Ibeo set up a branch in Eindhoven, Netherlands. In order to optimally serve the US market as well, Ibeo will open a location in the USA in 2019.

The company's sales are also growing rapidly. The demand for technical solutions around autonomous driving is higher than ever. The entry of Zukunft Ventures GmbH, a 100-percent subsidiary of ZF Friedrichshafen AG, which has been holding 40 percent of Ibeo since 2016, is providing additional growth. The customer portfolio includes companies around the globe: in the USA, Japan, China, Singapore, and of course, Germany. "Today, we combine our engineering expertise with overall responsibility for the product. Thanks to our partnership with ZF, we will be able to quickly and reliably supply the major automotive groups in the future," concludes Brumm.

So the future has not just started for Ibeo, but has been actively shaping it for two decades. And that not only applies to their own future, but also to the future of mobility.

## Ibeo Automotive LiDAR systems – at the speed of light for autonomous navigation

Hardly any current topic excites technically interested people more than autonomous driving. Intelligent assistance systems have long made many vehicles safer and more comfortable. Soon, cars and driving should be largely autonomous, bringing people to their respective destinations without a human being even at the controls, accelerator, or brake.

From modern assistance systems (ADAS, short for Advanced Drivers Assistance Systems) to autonomous driving (HAD, short for Highly Automated Driving), without LiDAR technology (short for Light Detection And Ranging), precise position detection of stationary or moving vehicles — and thus one's orientation on the road — would not be possible.

LiDAR systems emit laser pulses and evaluate the light reflected from different objects. From the light's travel time, which is the time required for the laser pulse to be reflected, software not only calculates the speed of the objects, but also their position and size to within a centimeter of accuracy. A rotating mirror on conventional LiDAR systems provides coverage over a specific viewing area — for example, within a 145-degree angle. Modern LiDAR systems work in parallel with several laser pulses: This enables a detailed 3-D model of the environment with moving objects, such as other cars, cyclists, or pedestrians, and static objects, such as lane markings or crash barriers. While cameras only draw a two-dimensional image that needs to be spatially interpreted by the software, LiDAR systems already provide a very accurate 3-D image. In conjunction with the relatively high range, this accuracy is a key advantage of LiDAR technology.

The merger of LiDAR data with other sources, such as cameras, radar, and ultrasound sensors, enables autonomous driving: the vehicle's electronic control unit (ECU) processes the data and passes on appropriate instructions (for example, necessary steering, braking, or acceleration) to the vehicle technology.

## Solid State Scanner as the next-generation LiDAR

LiDAR sensors, such as the ibeo LUX, work with mechanically moving mirrors and are thus able to detect objects on the road at a 110-degree angle with a distance of up to 200 meters (656 ft.), regardless of the weather.

LiDAR sensors work in the infrared range, invisible to the human eye, and have no health effects.

The solid state scanners, which are currently being developed, do without moving parts and rely instead solely on semiconductors. By eliminating mechanical components, solid state scanners are not only smaller, but also more robust, and therefore more reliable in the long term. They also excel with a high resolution. With a vertical “viewing angle” of up to 30 degrees, solid state scanners are already superior to their mechanical counterparts by around ten times. This is a decisive advantage, especially if the application is to cover the third dimension in the future — for example, in the control of drones.

## Facts & Figures and Press Contact

Locations: Ibeo Automotive Systems GmbH  
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High Tech Campus 69  
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Management: Dr. Ulrich S. Lages (CEO)  
Mario Brumm (Director of Operations)  
Michael Kiehn (Director of Sensor Development)  
Michael Köhler (Director of System Development)

Employees: over 350 (as of May 2019)

2018 Sales: about 31.5 million euros

Products: LiDAR sensors, software, and systems for automotive assistance and autonomous driving

## About Ibeo

Ibeo Automotive Systems GmbH is a worldwide technology leader in the field of LiDAR sensors (acronym for Light Detection and Ranging), associated products, and software tools. The technology is applied in cars as safety assistance systems, or in the field of autonomous driving. It is Ibeo's goal to reinvent mobility by enabling cars to become cooperative partners in the driving process, thus making transportation safer. Ibeo employs a total of over 350 employees in Hamburg, Germany, and Eindhoven, Netherlands. Since 2016, the Zukunft Ventures GmbH, which is a 100-percent subsidiary of the German automotive supplier ZF Friedrichshafen AG, holds a 40-percent share in Ibeo Automotive Systems GmbH. In 2018, the company celebrated its 20th anniversary.

For more information, visit: [www.ibeo-as.com](http://www.ibeo-as.com)

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