January 4, 2023
RF11599_en

Power up your senses #LikeABosch – innovative sensing solutions at the heart of everyday life

Dr. Tanja Rückert,

member of the board of management

of Robert Bosch GmbH,

and Mike Mansuetti,

president of Bosch in North America,

at CES®, on January 4, 2023

Check against delivery.

Robert Bosch GmbH
Postfach 10 60 50
70049 Stuttgart

Corporate Department
Communications &
Governmental Affairs
E-Mail
melissa.kronenthal@de.bosch.com
Phone: +49 711 811-45878

Executive Vice President:
Prof. Dr. Christof Ehrhart
www.bosch-press.com

Good morning everyone, and welcome to the Bosch press conference! After two years of virtual participation due to the pandemic, I'm so glad we can stage a live event again – and that I finally have the chance to be here in person, representing Bosch at the beating heart of the tech universe!

Of course the pandemic isn't over yet by any means – in fact our global challenges just seem to keep growing. Each year has brought a new set of challenges that add to the existing ones: war in Europe, rising inflation, energy shortages, devastating floods and fires... That's why we're particularly pleased that the CTA chose the theme of "Human security for all" for this year's CES. It recognizes the key role technology has to play in safeguarding and enhancing our safety, security, and well-being, as well as the health of our planet.

Today we'd like to talk to you about a piece of technology that plays an especially big role in all of this. It's everywhere yet nearly invisible, despite the fact that it underpins a huge proportion of the solutions we rely on in our daily lives. Since it doesn't occupy the limelight very often, we decided to make it the star of our latest "like a Bosch" campaign. As you probably guessed from the video you just saw, I'm talking about – sensors.

It would be hard to overstate the beneficial impact sensors have on our lives. They make our vehicles safer, they help us to improve our health, and they allow us to keep an eye on things that are otherwise hard to see – everything from temperature and pressure to the presence of harmful substances in our food and water. They save people's lives every day – for example by automatically identifying things like collisions and falls, and then triggering airbag deployment or a call for help.

And by making sure that help arrives quickly: did you know that pressure sensors in smartphones can pinpoint someone's altitude to

within a few centimeters? This can help first responders quickly locate someone inside a multi-story building; according to the FCC this could save more than 10,000 lives each year in the U.S. alone. Thanks to sensors, our lives are safer, we use fewer resources – we even breathe cleaner air.

Sensors also form the backbone of our connected world – without smart sensor nodes, the internet of things wouldn't even be conceivable. And as their capabilities increase, so too does their importance. Between 2019 and 2030, the global sensor market is projected to more than double in size to over 400 billion dollars.

At Bosch, we had a pioneering role in developing one of today's most important and widely-used types of sensors: the tiny yet powerful micro-electro-mechanical systems sensors, also known as MEMS. We're the leading global manufacturer of this technology – since we started in 1995, we've produced more than 18 billion MEMS sensors. And our business is still growing rapidly: over the last five years we've produced as many as in all the years before. Today there are an average of 22 Bosch MEMS in every car. You very likely have one in your pocket too: half the smartphones on the planet contain at least one of these Bosch sensors, and if you use a fitness tracker or smart headphones as well, you likely have quite a collection of them.

Over the years we've continued to refine MEMS by equipping them with increasingly sophisticated capabilities. But we've only uncovered the tip of the iceberg. Thanks to edge computing, sensors are becoming ever smarter, now not only able to detect and relay information, but process and analyze it as well. Increasingly, sensors can even learn from the data they collect, as we're now able to equip them directly with AI algorithms.

An especially promising new frontier is quantum sensing. Although still in its infancy, quantum sensing could soon allow measurements one

thousand times more precise than today's MEMS. This will enable faster and more accurate diagnosis of neurological conditions such as Alzheimer's, for example, and could revolutionize the use of prosthetic limbs. Last year Bosch established a startup to drive forward commercialization of quantum sensors and tap into a market which is forecast to reach up to 7 billion dollars in the coming years.

Our work on this cutting-edge technology underlines our company's strategy as a high-tech innovator and fits in well with our digitalization efforts. Over the next three years, we will be investing another 10 billion dollars in digitally transforming our business and expanding our workforce of 40,000 software engineers. In driving forward digitalization at our company, our ultimate aim is to find ever new ways of delivering on our "Invented for life" promise. To us, this means offering products and solutions that improve quality of life and offer real benefit for people. It also means keeping sustainability in the front and center of our development efforts, both by continuously improving the footprint of our products and by identifying sustainability-enhancing applications for them.

But we'll talk more about the intersection of technology and sustainability in a minute. And, we'll look at findings from our second Bosch Tech Compass survey that give us some insight into consumer perspectives on this topic.

First, we'd like to tell you about some of the ways we're putting our sensor expertise to use in beneficial solutions. In fact, this is what sets us apart from most other sensor suppliers; we don't simply produce this crucial building block, we use it as the basis of a wide variety of hardware, software, and services that are transforming the way we move and live.

The first domain in which our sensors found widespread use was in automotive applications, and Bosch remains one of the leading

manufacturers for the automotive industry. Among other things, Bosch sensors help with vehicle navigation, control airbags and ESP systems, and enable numerous assistance functions that enhance driving safety, comfort, and efficiency.

Sensors are particularly indispensable for automated driving. As one of the trailblazers of this technology, we're putting our sensor expertise to good use in solutions that are taking us ever closer to the driverless vehicles of tomorrow, while already enabling cutting-edge driver-assistance systems. We produce a wide range of sensors that help cars independently monitor their surroundings, including radar, video, and ultrasonic. We're also working on an automotive-grade long-range lidar sensor.

A great example of what sensors are enabling us to achieve in this domain is the **automated valet parking** function we developed with Mercedes-Benz. In fact, we just passed a major milestone with this technology: in November, Germany's Federal Motor Transport Authority approved this highly-automated parking system for use in the parking garage at Stuttgart Airport. This makes it the world's first SAE Level 4 parking function to be officially approved for commercial use. Imagine a world where you won't need to waste your time looking for a parking space! It's almost here.

But increased convenience is not the only way we're improving life behind the wheel. Here at CES, we're presenting a new sensor-based innovation designed to enhance safety for drivers as well as passengers in ridesharing contexts. Our new **RideCare companion** is a full-service hardware and software solution. Consisting of a connected camera, wireless SOS button, and cloud-based data services, it goes beyond just recording footage: in case of need, remote operators can view inside the vehicle and provide active help. At the moment, we're envisioning it as a valuable safety net for gig drivers. Looking further ahead to the automated, shared mobility of the

future, we see this solution as an essential tool for ensuring the safety of all vehicle occupants. The CTA thought so too and gave it a Best of Innovation Award!

Of course, sensors have applications beyond traditional motorized vehicles – at our booth, we're showcasing our latest e-bike innovations under the tagline "Safety via sensor tech." I'm especially excited about our new **eBike ABS**, which will have its U.S. launch later this year. Just like with cars, ABS for bicycles works with wheel speed sensors, and prevents the front wheel from locking up during hard braking by regulating braking pressure.

There are so many situations on a bike when fast, stable braking is critical: when you're hurtling downhill and a car door opens in front of you, or you have to come to a sudden stop on a wet surface while transporting kids in your cargo bike. In scary moments like these, eBike ABS not only helps maintain both stability and steerability, it also reduces the probability of rear-wheel lift. This is life-saving technology: our research shows that equipping all e-bikes with this system could reduce accidents involving them by nearly a third.

On the subject of accidents, of course we can't prevent them all. But when they do happen, we try to mitigate the effects. This is the intention of our new solution called **Off-Zone Crash Detection.** It's designed to help protect vehicle occupants during so-called "off-zone" collisions: these are side impacts to the front or rear of the car which happen most often during lane changes and merging, and which traditional safety systems can fail to detect. The idea actually came from one of our U.S. engineers who had this kind of accident and discovered that it didn't trigger his occupant protection systems. He came up with a clever solution that repurposes airbag sensors in conjunction with a new software algorithm to reliably detect these types of impacts. It's a great example of how we're using software to get more value out of existing hardware and provide beneficial new

features to drivers on the road – and it was also named a CTA Innovation Award Honoree!

Beyond the mobility domain, MEMS sensors enable or enhance many of the high-tech devices we use in our daily lives. A lot of you are certainly familiar with virtual reality technology, which also relies on sensors to create a dynamic, interactive image. But are you aware of the numerous applications for it beyond entertainment and gaming? The field of VR-based therapy holds particular promise. We currently have a project running in Copenhagen, Denmark, involving a new Bosch solution called **VR Bus Ride**. It's being used to help young adults with learning disabilities to become more independent: they gain confidence dealing with the challenge of riding a bus by experiencing it in a VR context before attempting it in real life. The results have been extremely empowering for the young people involved, and we're currently exploring a number of other therapy-based applications for this technology.

Last year we told you about a new piece of sensor technology we're particularly proud of: our new AI gas sensor at the heart of **Dryad Silvanet**, a wildfire early-detection system that has the potential to be a true game-changer. This past summer, in fact, a Dryad unit detected its first wildfire in the field in Germany, allowing a swift and effective response from local fire fighters. After running numerous proof-of-concept trials worldwide last year, the Dryad system will be going into mass production this year.

If helping improve quality of life and bringing people real benefit is one of the cornerstones of our development work, our commitment to achieving greater sustainability is the other – and this is as true for sensor technology as it is for all our areas of business. It's also driving technological advancement, both in how we build our products and in what they're capable of.

Staying with sensors, you may think there's not much sustainability potential to be leveraged in the making of a product so small. Well, you'd be wrong. When Bosch began producing MEMS sensors in 1995, the edge length of an acceleration sensor was still over 13 centimeters. Today, the most compact MEMS sensor we make is smaller than a pinhead with an edge length of just 1.28 millimeters. That's a reduction in size by a factor of 97, while at the same time we've slashed MEMS power consumption by a factor of 100, all while continuously improving functionality.

And we're still achieving gains: for instance, we're showcasing a range of new MEMS sensors here at CES which in addition to featuring industry-leading robustness and accuracy, are setting new standards in terms of size and efficiency. These include our **programmable inertial measurement unit with integrated AI,** which is the world's first self-learning fitness sensor and is now both 50 percent smaller and draws 50 percent less current than the previous model. We also have an exceptionally rugged **barometric pressure sensor** which offers best-in-class accuracy while consuming 85 percent less power than before. And we have a high-performance **magnetometer** which features our unique field shock recovery feature, meaning it's extremely resistant to external magnetic fields, and it requires 20 times less power than the previous generation.

Across all our product classes, we're developing solutions and services aimed at tackling our most pressing environmental challenges. In the mobility domain, we continue to drive forward innovation in the twin areas of electrification and hydrogen fuel-cells. Where electrification is concerned, here at CES we're demonstrating our new **eAxle city**. It's an especially light and compact all-in-one electric drive solution for use as the main drive in smaller vehicle classes or as a secondary drive for an extra boost. It features power modules based on highly-efficient silicon carbide semiconductor technology for longer ranges and faster recharging times.

From light duty to heavy duty vehicles, we're continuing to pursue development of **mobile hydrogen fuel cells**. Our commitment in both of these areas is also reflected here in the U.S. In the latter part of 2022 we announced two major developments in South Carolina: we started manufacturing electric motors in Charleston and plan to start producing fuel cell stacks in Anderson.

It's not all about physical products, though – we're leveraging our digitalization and software expertise to achieve sustainability gains too. For example, we recently launched a new solution called **Autotrace**, an end-to-end digital solution that uses blockchain technology to help enable a circular economy for the manufacturing and automotive sectors. By tracking and monitoring critical aspects of the supply chain – including parts provenance, carbon emissions, and materials of high concern – Autotrace can help streamline inventory management and enable responsible disposal and reuse. The idea is to provide incentives for manufacturers to adopt circular economy practices and drive circular behaviors across the entire supply chain.

Another great example of our digital activities is the partnership we recently announced with **IBM** in the field of quantum computing. Together, we're going to be harnessing the ultra-powerful computers of tomorrow to look for alternatives to the precious metals and rare earths currently used in carbon-neutral powertrains. For Bosch, such alliances are an important building block for expanding our technology leadership. They're also essential from a sustainability standpoint, since we're convinced that working together is the key to finding solutions to our biggest challenges.

As an international enterprise, it's not lost on us that we carry a particular burden of responsibility when it comes to the carbon footprint of our operations and the impact of our solutions on people and the planet. Above all, we want to demonstrate how if the right path is

taken, the twin aims of profitability and sustainability can go hand in hand.

We have long known that our commitment to sustainability is important to our customers. And now we have hard evidence showing just how important it is to everyone. A year ago at CES, we introduced the first **Bosch Tech Compass**, a survey we conducted on global attitudes to technology. As a follow-up, we took an even deeper dive with a new set of questions and a wider set of respondents representing seven countries in total.

The results of the second survey were an even clearer affirmation of consumer support for sustainable business practices. For example, an incredible 85 percent of survey respondents said they think the use of sustainable technologies should be an essential part of every company. At the same time, nearly as many – 82 percent – believe that the more a company focuses on sustainable technologies, the more successful it will be in the future.

This is great news for Bosch – and for the planet. You see, if we can assume that these strong feelings translate into purchasing behavior, then more than four out of five people worldwide are choosing to support companies that develop or use sustainable technologies. This momentum could accelerate the development of even more sustainability-enhancing innovation. It could be considered a positive feedback loop, and it's a win-win for everyone.

A win-win – we definitely need more of those! In times of such uncertainty, it's encouraging to know there is one thing we can be optimistic about. Whether in the form of indoor location tracking, e-bike accident prevention, or quantum algorithms to accelerate the journey to carbon-neutral mobility, technology is making our lives ever safer, easier, and more sustainable. And as a company on the leading edge of technological innovation, we know for a fact that there is untold

potential still waiting to be tapped. One of the ways we're doing this is with those miniature marvels we call sensors. As the unseen backbone of our modern world, they're responsible for many of the beneficial applications we rely on in our daily lives. And despite their super small size, they will continue to play a very large role in enhancing quality of life and reducing our impact on the planet. How can we be sure? Because we're already working on it.

Ultimately, that's what it's all about for us: in everything we do, we strive to bring about a better tomorrow with our innovations. For Bosch, this is "Invented for life."