



BOSCH

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**New conceptions of mobility, new perceptions of
technology: Bosch is driving transformation**

A presentation by Dr. Volkmar Denner,
chairman of the board of management
of Robert Bosch GmbH,
and Prof. Stefan Asenkerschbaumer,
deputy chairman of the board of management,
at the annual press conference on May 4, 2017

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Rarely, ladies and gentlemen, ...

... has it been as exciting to work for Bosch as it is now. Change, both in our business environment and within our company, is demanding our attention and rousing our competitive spirit. At this exciting time, I welcome you to our annual press conference. The speed and depth of this transformation are plain to see, particularly in mobility, but also across technological developments in general. The major catalyst for this change is connectivity – in our industry and in our company. It is changing business models, products, and not least the world of work itself. A desire simply to defend a leading market position in familiar areas of business is no longer enough. The transformation process is profound. We must become its driver and put ourselves on the vanguard wherever possible – in other words, we must seize the opportunities of the new. In that sense, Bosch is not merely a company in the midst of a transition, but one in the midst of an upheaval.

Today we will be presenting a number of examples that illustrate what we mean by this. But first, a look at the main points of today's press conference:

- In 2016, we continued on our growth trajectory, and this without any economic tailwind and despite negative exchange-rate effects. Our sales rose from 70.6 to 73.1 billion euros, while our EBIT from operations came to 4.3 billion euros.
- In 2017, we again want to grow faster than the markets that are relevant for us. Our sales have already risen by 12 percent in the first quarter. In view of global economic uncertainty, our aim is to achieve growth of between three and five percent for the year as a whole. Even as we continue to invest heavily in our future, we are looking to improve our margin.
- Beyond this year, we are plotting a course for sustainable success. In existing business areas, we want to expand our market and technology

leadership – from a position of strength. In many new areas, such as connectivity and artificial intelligence, we want to build up a competitive market position.

It is our longer-term objectives in particular, ladies and gentlemen, that bear witness to the dynamism of this transformation at Bosch. Our business environment is changing not only as regards technology and business, but also more than ever politically, or indeed populistically. Bosch is international on the basis of a deeply held conviction – we want one world and, above all, one Europe – without nationalism. Globalization benefits our business; the return of borders hurts it. And most importantly, our associates come from 150 different countries – companies like Bosch are “united nations” in their own right, and we want it to remain that way, even in the face of populist siren songs.

Our commitment to environmental protection and resource conservation is equally deep – so to us it seems paradoxical that the mayors of Mexico City, Paris, Athens, and Madrid chose a climate conference as the venue to announce a ban on diesel vehicles. Bans of this kind are even being discussed in countries such as Germany, countries which are likely to fall short of their own emissions targets. Regardless of the fact that a higher share of diesel-powered vehicles means less CO₂ from road traffic overall. And regardless of the fact that, following the introduction of the particulate filter, diesel engines emit almost no particulates. Even their nitrogen-oxide emissions have already been greatly reduced – and of course new laws demand that these limits must in the future also be complied with on the roads. Quite a lot remains to be done. In the world’s metropolises and here in Stuttgart, air-pollution control needs to be a central objective – for industry, politics, and society. But all the parties need to engage constructively in this debate, and stick to the facts. A ban on diesel vehicles would be a knee-jerk reaction that flies in the face of environmental and economic facts – it would harm not only jobs and trade, but also climate action itself. Of course, politicians are absolutely within their rights to mandate stricter emissions limits – but these should continue to be

technology-neutral. In other words, they should seek neither to promote nor to demonize a solution such as the diesel engine. The automotive industry, Bosch included, will do its fair share to keep air pollution under control. How? By making combustion engines as eco-friendly, and electrical powertrains as affordable, as possible. Some 50 percent of our research and development spending is aimed at conserving resources and protecting the environment – never has Bosch ingenuity been in as much demand as it is today. But the creativity of our engineers must not be restricted by politics – because it is precisely this creativity that could make vehicle bans technologically superfluous. We are already well on the way to achieving this, as I will show you later.

Let us look first of all at how our business is doing. Mr. Asenkerschbaumer will now give you an overview of how business developed over the past year as well as the outlook for the current year. After that, I will explore our strategic topics in greater depth.

Business figures: marked by the coming transformation

Ladies and gentlemen,

Before Mr. Denner discusses our strategic focal points, I would now like to turn to the financial figures for 2016 and give you our outlook for 2017. In many respects, the figures reflect upfront investments for the coming transformation. To give you the news upfront, in 2016 the Bosch Group made further progress. Against the backdrop of only moderate growth in the global economy, Bosch achieved good growth and we notched up a series of successes. One of the major challenges we face in the coming years will be to achieve a balance between the upfront investments necessary for the transformation and an equally necessary high level of profitability. After all, it will be quite some time before many of these upfront investments pay off.

But first things first. Let us take a look back at the economic environment around the world. In 2016, the global economy once again achieved only

moderate growth. Global GDP rose by just 2.5 percent. In the second half of the year, economic activity picked up in Asia, and especially in our core market of automobile production. Worldwide, this grew by 4.5 percent – much more strongly than originally expected. In contrast, developments in our other core markets tended to be moderate, as shown by indicators such as global production in the mechanical engineering sector, private consumption, and global construction activity.

Turning now to our business figures, the Bosch Group's sales revenue climbed 3.6 percent year on year in 2016, to 73.1 billion euros. Unlike in the previous year, there were no significant consolidation effects. However, reported sales were burdened by 1.3 billion euros in exchange-rate effects. Setting aside these effects, our sales rose by 5.5 percent. In other words, we achieved good sales growth in 2016, Meeting our declared target range of 3 to 5 percent for sales growth. Indeed, after adjusting for exchange-rate effects, we even surpassed it slightly.

The Mobility Solutions business sector reported the strongest growth in 2016. Here, we increased sales by 5.5 percent; adjusted for exchange-rate effects, growth was 6.9 percent. We benefited from strong demand for gasoline direct injection systems, driver assistance systems, and display systems. Following a comprehensive restructuring, our Electrical Drives division is now on a growth trajectory with new products. The e-bike business continued to develop very strongly. It is an example of a successful start-up.

The Industrial Technology business sector, and especially the Drive and Control Technology division, is still struggling in a very difficult market environment. Sales once again declined – by 5.2 percent in nominal terms to 6.3 billion euros, a drop of 4.2 percent allowing for exchange-rate effects. However, the impact of a baseline effect cannot be underestimated: at the end of 2015, we disposed of our large gearboxes business. In addition, the market for packaging machinery did not develop as we had expected.

The Consumer Goods business sector was once again successful. In 2016, its sales revenue came to 17.6 billion euros. In nominal terms that equates to just 2.6 percent growth, but adjusted for currency effects it was 5.7 percent. We are very satisfied with the way business has developed at BSH Hausgeräte. The focus there is on connectivity and the expansion of its international business, particularly in growth markets such as China and India. Meanwhile, the Power Tools division, too, developed well once again. The division's success is thanks to its consistent focus on the user. Users are involved in the development of new products and services from the beginning.

We are giving the Energy and Building Technology business sector a clear customer focus on products and solutions for private customers, product solutions and services for commercial customers, and business process management. In 2016, we created a specific division for this latter area: Bosch Global Service Solutions. This builds on our Security Systems division's existing service network. The new division got off to a flying start with double-digit growth. In terms of products, 2016 was a very successful year for connected boilers. Overall, this business sector was particularly affected by the exchange-rate burden. In euro terms, sales rose by just 1.7 percent to 5.2 billion euros, but allowing for exchange-rate effects growth was 4.5 percent.

Let us take a quick look at developments by region. In Europe, still responsible for over half our sales, we achieved 3.4 percent sales growth to 38.6 billion euros, or 4.8 percent allowing for exchange-rate effects. Exchange-rate effects here were unusually high, not least due to the depreciation of sterling. In North America, we felt the full force of the slowdown. Sales revenue slipped 2.2 percent, or 1.8 percent adjusted for exchange-rate effects. Happily, though, we finally achieved exchange-rate adjusted growth in South America, at a rate of 2.4 percent. The fact that nominal sales fell by 5 percent is in large part due to the continuing depreciation of the Brazilian real. Once again, sales growth was strongest in Asia Pacific, where sales revenue grew

by 8.3 percent to reach 20.8 billion euros. We now generate around 28 percent of our sales there. After adjusting for exchange-rate effects, we managed to increase our sales by 12 percent.

That brings me to our result. On aggregate, we generated an EBIT from operations of 4.3 billion euros, which equates to an operational EBIT margin of 5.8 percent. As we said at the start of the year, when we presented our preliminary figures, EBIT is down year on year. The difference between this figure of the disclosed EBIT of 3.3 billion euros results in large part from depreciation and amortization in connection with the full acquisition of the former joint ventures BSH Hausgeräte and Automotive Steering, which were fully consolidated for the first time in 2016. Last year, positive one-off effects from the acquisition helped compensate for the charges from this depreciation and amortization. Other effects include investment write-downs and charges arising from legal proceedings relating to antitrust and emissions issues.

As I said at the beginning, we face the challenge of making significant upfront investments for the coming transformation while maintaining a consistently high level of profitability. These upfront investments include increasing expenditure on research and development as well as high levels of capital expenditure with an impact on depreciation and amortization. Then there are numerous other upfront investments in initiatives relating to digitalization and in projects that aim to increase the efficiency of our shared services.

What is more, we are realigning our traditional areas of business in response to changing requirements and markets. Bosch Rexroth is undergoing a comprehensive restructuring in the face of lower market volumes. We announced adjustments to this effect last year and at the start of 2017. At the same time, we are making great efforts to drive forward promising areas such as Industry 4.0. Additional adjustments are necessary, for instance with regard to electric steering in our Automotive Steering division. Furthermore, the carve-out of the Starter Motors and Generators division involved considerable costs. Two days ago, we signed a deal to sell the division. We are pleased to have found

the right partners for the division in the shape of the Chinese industrial enterprise Zhengzhou Coal Mining Machinery Group and China Renaissance Capital Investment.

Following this detailed explanation, I would now like to turn briefly to the development of result by business sector. Mobility Solutions achieved an operating result of 2.6 billion euros. This is down on the previous year. I have already spoken about the pressures faced. Encouragingly, Industrial Technology returned to profitability, with an EBIT of 44 million euros. Our Consumer Goods business was very successful. Despite exchange-rate burdens, the Energy and Building Technology business sector managed to maintain the previous year's result.

Let us now look in more detail at capital expenditure as well as research and development expenditure. We increased our research and development expenditure by some 0.6 billion euros to seven billion euros, or 9.5 percent of sales, compared to 9 percent in the previous year. Our upfront investments are particularly noticeable in this area. Among other things, they focused on expanding driver assistance systems, car multimedia, and sensor technology.

We also further increased our capital expenditure. In 2016 this amounted to 4.3 billion euros; the capex ratio rose to 5.8 percent of sales revenue. We expanded our capacity in a number of areas. Here, too, the Mobility Solutions business sector was particularly noteworthy: capital expenditure rose to 3.3 billion euros, compared with 3.1 billion euros in the previous year. We also greatly increased capital expenditure in Consumer Goods to 720 million euros from last year's 650 million euros.

I will now turn just briefly to the structure of the statement of financial position. There were no major changes here. It remains sound, with an equity ratio of 44 percent. Moreover, we have liquidity as reported in the statement of financial position of 16.7 billion euros, compared with the previous year's 14.4 billion euros.

So what are the prospects for the future?

Our forecasts for the global economy assume a slightly higher rate of growth of 2.8 percent, compared to the 2.5 percent mentioned for 2016. But the risks are significant, given political developments and increasingly protectionist tendencies. The latter trend is by no means a new development. It has been growing ever since the end of the global financial crisis, as WTO statistics show. This is not a question of customs duties, but rather of issues such as local-content regulations, licenses, and product standards.

Despite a good start to 2017, with sales growth of 12 percent in the first quarter, our forecast for the Bosch Group is cautious, given the uncertainty of the business environment. All our business sectors have grown rapidly in the first quarter. Mobility Solutions has led the way, with growth well into double figures. Once again this year, we will be making major upfront investments for the coming transformation. Nonetheless, following a drop in 2016, we want our margin to return to its 2015 level. Our aim is to strengthen our profitability, since the transformation ahead of us is more of a marathon than a sprint. And with that, I would like to hand back to Mr. Denner.

Strategy: Bosch must stay ahead of possible disruptions

...Thank you, Mr. Asenkerschbaumer. As promised, I will now explore the strategic question of Bosch's transformation in greater depth. It is a transformation that goes deeper for this company than any other since the beginning of the age of electronics over 50 years ago. To a great extent, it is driven by changes in our business environment. Above all, we see two major areas of disruption:

- First, the challenges for road traffic I mentioned earlier. These are driving change in our core mobility business. It is now no longer simply a question of building better cars. We need new conceptions of mobility.
- Second, technological change on the internet of things. Together with artificial intelligence, this will change the way each and every one of us lives – and we are convinced that it will be a change for the better. Personal assistants are one example.

If they are well understood, changes like these are the best thing that can happen to a company that is a market and technology leader. They trigger our entrepreneurial sensors and drive our competitive spirit. However, for a company like Bosch, such changes are a dual challenge:

- On the one hand, we must further develop our existing, very successful businesses.
- On the other, we need to be quick to seek out new businesses, so we can stay ahead of possible disruptions.

The transformation of traffic: Bosch is working on a new kind of mobility – emissions-free, accident-free, stress-free

It is above all in Mobility Solutions, our biggest business sector, that we must tackle this dual challenge. Road traffic as we know it will undergo radical change. First and foremost, the environmental requirements placed on cars are growing, as I said. We must strike a balance between mobility and air quality – most importantly in major cities, which will be home to nearly 70 per cent of the world's population by 2050. In the short term, nitrogen-oxide emissions from diesel engines in real driving conditions must fall further. This is the only way that automakers will be able to comply with Euro 6 standards, which are mandated by the new laws on real driving emissions, or RDE for short. To support them, we have developed a raft of initiatives, from injection technology to exhaust-gas treatment. What will be decisive, however, is how they are calibrated for each type of vehicle. Bosch is currently running almost 300 RDE projects – there can be no clearer expression of the intensity of our development efforts. We are doing all we can to help keep the air clean and limit global warming. We can only hope that other sources of emissions are tackled with the same intensity.

This goes for particulates, too. Road traffic is responsible for only 12 percent of particulate emissions. Once the particulate filter was introduced, the particulate emissions from diesel engines became negligible. Such filters will also be installed in spark-ignition engines. With injection pressure increased to 350 bar in gasoline direct injection systems, this will also solve the particulate issue in gasoline engines. Of course, in all the talk of particulates, one fact tends to be overlooked: The majority of automotive emissions come not from the exhaust, but from brake and tire wear. That is why Bosch is also developing the iDisc, a brake disc with a special coating that generates considerably less brake dust.

Bosch is in any case working not just under the hood to keep the air clean. We are equally concerned with making traffic efficient – which is precisely

why our mobility solutions are more than just automotive technology. We have developed a mobility assistant for the Greater Stuttgart area – an app that lets users plan, book, and pay for journeys that involve different modes of transport. And we want to bring daily traffic congestion caused by the search for parking in our cities down by 20 percent. To this end, we have developed a range of solutions for connected parking – including cars that identify parking spaces as they drive past and send this data over the internet to a real-time parking map.

We call this solution community-based parking; having announced it two years ago, the first production projects will start work next year. So we're as good as our word. A reduction in the tiresome, time-consuming search for parking is yet another way we are helping keep the air clean.

At the same time, these examples shed light on a new kind of mobility – the car as a part of the internet of things as well as road users that switch flexibly from cars to bikes, trains, or buses. What will Bosch's role be in this mobility of the future? For decades, our 3S program to help make driving safer, cleaner, and more economical has served us well. The systems in question have enjoyed lasting success – sales of our gasoline direct injection systems are up 15 percent this year, and those of our ESP anti-skid system 10 percent. In the future, cars will be electrified, automated, and connected – also with other modes of transport. Our objectives go beyond the hood, and they are no longer relative but instead absolute. We no longer want to reduce driving hazards, we want to cut them to zero. No emissions, no accidents, no stress – that is our vision of the relaxed mobility of the future.

We are putting plenty of power into driving the transition to electromobility, too. Powertrain Solutions is the name of the new division that will pool our strengths in gasoline and diesel systems as well as in electric drives. We are pursuing a dual goal here, also to secure jobs during the transformation: our systems for internal-combustion engines make us number one in the market, and we want to stay that way – but we also want to attain this position as a

supplier in the electromobility field. We are making progress on all sides: More than 30 electromobility projects featuring Bosch technology are already in production. In 2016, we won 11 orders in China alone – already the world’s biggest market for electric cars. Our development efforts are directed at making electrical powertrains suitable for the mass market. This is an objective we are pursuing on two paths. First, we are increasing the efficiency of the powertrain system by integrating the transmission, power electronics, and motor into one electric axle. Second, we are looking into ways of doubling the energy density of batteries from their 2015 level by 2020. In all this, there is one thing we have not lost sight of. The internal-combustion engine itself can be an alternative powertrain, eco-friendly and CO₂-neutral. The requirement for this is synthetic fuels produced using renewable energy, or synfuels, as they are called. We are also committed to encouraging their wider use.

Our progress in automating driving is especially rapid. In recent weeks, we took two strategically important steps, both of them focused on the start of the next decade:

- First, we are entering into a development partnership with Daimler in order to enable automated driving in cities, in other words in highly complex driving situations. Success in this first decisive step will bring us closer to a revolution in personal mobility.
- Second, together with Nvidia we are building the “AI onboard computer” – the very brain of self-driving cars. With the help of artificial intelligence, we are making cars clever enough to interpret and predict the behavior of other road users.

In addition, before this decade is out we will have managed to create an essential prerequisite for automated driving: an ultra-accurate map that also contains the readings from our radar sensors. We are working on this together with TomTom, as well as with the Chinese providers AutoNavi, Baidu, and NavInfo. This radar signature will enable self-driving cars to determine their location with precision. Bosch has a total of almost 3,000 engineers working on automated driving – an increase of 500 over the last year. Driver assistance is already a major growth business for Bosch: it was only in 2016

that our sales first passed the billion-euro mark – while orders last year were worth 3.5 billion euros. In 2017, the market for driver assistance systems will grow by some 30 percent. At Bosch, it will grow even faster.

Finally, we believe that making driving connected is a key competence, since it not only supports electrified and automated driving, but also enables web-based services for all those traveling from A to B. By the start of the next decade, the market for connected mobility will grow by almost 25 percent each year; by 2020, it is expected that 250 million vehicles will be part of the internet of things. That is why we will be launching the Bosch Automotive Cloud Suite next year. It is a software platform that can be understood as the heart of connected mobility. The suite will enable both us and our customers to quickly establish new mobility services – whether predictive diagnostics or online parking. A vehicle in the exhibition outside demonstrates several such applications, for instance access to the smart home. Once the Automotive Cloud Suite is launched, we will introduce functions like these one by one. Connecting cars with houses is something that a company like Bosch, which is at home in both realms, is predestined to do.

Seen from this perspective, the car is not just something to be driven, but also a kind of personal assistant supporting the driver. The basic technology for this is also integrated into our show car – and now I would like to show you a short film about this technology...

Drivers can talk with their virtual assistant just as they would with a passenger – only this passenger responds to the driver's instructions and carries them out. In the process, it learns to understand the driver's habits and preferences better all the time – fetching information from the cloud, a smartphone, or the smart home as necessary. Fundamentally, this kind of assistant can accompany users not just in the car but also in the kitchen, in the garden, or when doing DIY – making it technology invented for all areas of life.

The transformation of technology: Bosch is using artificial intelligence to make connectivity an emotive experience

Here, at the very latest, is where the second major driver of our transformation becomes apparent: the rapid pace of technological development, which is also the catalyst for change at Bosch. Progress with the internet of things (IoT) and with artificial intelligence (AI) is relevant to almost all Bosch businesses. We are putting all our energies into driving this progress. We sold 27 million web-enabled products in 2016 – and it is our stated aim to make every new electronic product connected and develop related services. We now expect that in ten years' time, every new Bosch product will either be developed and produced with artificial intelligence or will itself have AI. The one relates to the other: artificial intelligence makes connectivity a personal, even emotive experience. It enables us to create technologies that support people in their everyday lives, that learn from data, and that relieve their users of the burden of daily chores.

The potential of these new technologies can also be seen in economic forecasts. We estimate that the worldwide market for the internet of things will grow by 35 percent each year until 2020, reaching a value of 250 billion U.S. dollars. The global semiconductor market offers another clear indication. Chips for the internet of things are the strongest drivers of growth, even ahead of mobile telephony and automotive applications. Not least, the number of digital assistants will triple to over 1.5 billion by the start of the next decade.

Against this backdrop, Bosch is further expanding its strengths in the interplay between connectivity and artificial intelligence:

- At the start of this year, we established the Bosch Center for Artificial Intelligence, or BCAI for short. It is spread across sites in Renningen, Palo Alto, and Bengaluru. We can build on a solid base of expertise here, for

instance in image analysis, as used for video surveillance in our security systems. Furthermore, we presented Kuri, our home robot with elements of artificial intelligence, at CES in Las Vegas. The BCAI will initially focus above all on supporting the development of automated driving and connected manufacturing.

- We are strengthening our “3 S’s” for connectivity: sensors, software, and services. Sensors – we are the world’s largest manufacturer of micromechanical sensors. Software – we employ more than 20,000 software engineers, nearly 4,000 of whom are working exclusively on the internet of things, an increase of almost 1,000 in a single year. Services – we are developing not just new technology, but also entire business models. We are currently evaluating some 100 projects, of which one in three is already either in the roll-out or ramp-up phase. Our Coup e-scooter service is one example. The importance of projects like these must not be underestimated, since services and applications will make up more than half the market for the internet of things in a few years’ time.

But it would make no sense for Bosch to try to open up the connected world on its own. Our motto here is openness; we want to collaborate and enter into partnerships. For example, we offer microservices from our Bosch IoT Suite software platform not only on our own cloud but also through Amazon Web Services and IBM Bluemix. The logic of the connected world points to partnerships like the ones we have entered into with GE, SAP, and Software AG. Not only things, but also companies are becoming connected – in three steps: first, joint development in open source communities; second, reciprocal use of technical components; and third, joint projects like the ones we are engaged in for Industry 4.0.

Connected manufacturing in particular can only be the result of a combined effort. At Bosch, we are pursuing a clear vision: we want Industry 4.0 to make the entire value stream more efficient, from suppliers to end customers. We see this area as one that will increasingly offer business opportunities:

- As a leading user, we can improve our productivity. In 2016 at our Feuerbach plant, for instance, we tested the maintenance support system – and found that it reduced production downtimes by 20 percent and increased machine availability by 5 percent.
- As a leading provider, we are translating our expertise from in-house applications into external sales. In this respect, the innovation we recently showcased at Hannover Messe is significant: it is the very maintenance support system I just mentioned. We are noting an increase in customer inquiries about our Industry 4.0 solutions. The target we have set remains the same: to achieve cumulative additional sales of more than a billion euros from new products and services for connected manufacturing by 2020.

Industry 4.0 is going to take hold in factories, then, but there is one factor that must not be neglected: people should always be the central consideration. Whatever the economic benefits, it is important to us to see our associates as key players in connected manufacturing. Relieving them of routine work and giving them more time for creative tasks is the crucial success factor for Industry 4.0 at Bosch. We want humans and machines to work together in intelligent teams – and we have taken this as the organizing principle for our apprenticeships, which are available in 30 countries around the world. In Germany, for instance, we provide robotics training to all our technical apprentices at our Blaichach plant, while in Homburg we have set up a learning island on sensor- and software-based maintenance. For Bosch, Industry 4.0 is more than technology, it is inextricably interwoven with Work 4.0.

**Change at Bosch: combining
the power of a large company with the agility of a start-up**

Ladies and gentlemen, I now come to the close of my talk. Regardless of whether we are discussing changes in our industry, in technology, or in the world of work, this process of change is sensitizing and motivating our workforce. What has become clear is that Bosch has the power of a large company and yet in many areas it demonstrates the agility of a start-up. So before connectivity, automation, and artificial intelligence change everything in the sectors we are active in, we are changing ourselves. Bosch is a company with many strengths. One of them is the ability to continuously evolve in order to remain successful in the future.