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N. Lang:

Ladies and gentlemen, welcome to our session, the Coming Revolution in Transport. My name is Nikolaus Lang. I am Senior Partner and Managing Director at The Boston Consulting Group (BCG), heading our global mobility practice. It is a great pleasure for me to introduce a very distinguished and I would say multimodal panel to discuss the future of transport.

On my right is Mr. Sergey Kogogin, Director General OJSC KAMAZ, who will share with us the perspective of the truck manufacturer and what will be the Smart Truck of the future. On my left is Mr. Bo Andersson, President of AVTOVAZ, Russia's largest car manufacturer. We will hear his view on how cars will fit into the revolution of transport. To my right is Mr. Aleksey Tsydenov, Deputy Minister of Transport of the Russian Federation.

We will discuss the impact and the relationship between private companies and public companies, which play an important role. To my left is Mr. Valentin Gapanovic, Senior Vice President for Innovation Development at Russian Railways. In a multimodal world, railways will obviously play an important role, and we are very fortunate to have Mr. Gapanovic with us. To my right is Mr. John Wories, the CEO of Amsted Rail. He is digitizing trains, and making them more effective, more fluid. To my left is Mr. Christian Morales, Vice-President, General Manager Europe, Middle East and Africa (EMEA) at Intel Corporation, who will show us the IT dimensions of the future transport. To my right I have Mr. Heinz Hermann Thiele, Owner of and Chairman at Knorr-Bremse Group, a major supplier of automotive and rail components. We will have an interesting discussion on the future of autonomous driving.

We also have our extended panel in the front row. I would like to welcome Mr. Ville Iho, Chief Operating Officer at Finnair Plc, who will share his view of the airline industry today. Welcome to Mr. Herbert Ortner, CEO at PALFINGER Group. As a key transport equipment player, Mr. Ornter will discuss with us the role of the integration of the supply chain. And a welcome to Dr. Eberhard Zeeb,

Senior Manager Driving Automation at Daimler AG, who plays a key role in making autonomous driving really happen.

Before I invite every panelist to share his view on what will be the revolution of transport, allow me share three themes which we at BCG think will be part of the revolution in transport, having worked 20 years in this mobility area.

The first theme is autonomy and connectivity. Today we still have a very traditional way of transport. However, if we project 20 to 25 years ahead, the majority of transport modes will be connected to the Internet or connected digitally, and be highly autonomous. When we talk about autonomous driving, we are talking about 10% autonomous vehicles on the road by 2025, and up to 25% by 2035. This is associated with many risks, including cyber security as well as the law.

I would like to remind you, however, of three key numbers, which I would describe as 90, 60 and 30. These are, from our perspective, the key benefits of autonomous vehicles: 90% fewer accidents, 60% more throughput on roads, and 30% less fuel emission and less fuel usage. There is thus a tremendous potential in making cars, trains, and trucks more autonomous.

The second theme, in terms of a revolution in transport, is multimodal fusion. This means that in the past we focused on cars, on trucks, and on trains. A single-transport-mode perspective. As we progress, we will increasingly have an end-to-end perspective. Whether it is goods or passengers. This does not mean that any one mode of transport is a priority – it is the mobility experience that counts. This includes bikes, subways, trains, cars, or planes. Multimodal fusion is something that we see as very important.

The third theme is that all of the above – autonomous transport means, multimodal fusion – only work if public authorities and private companies work together in a seamless manner. We will not have autonomous vehicles, nor this revolution in transport, unless the public authorities provide the legal framework as well as the infrastructure, to a certain extent, to make this happen.

That is one of the big challenges of public-private cooperation that will happen in the next 10 to 20 years, and is needed to make the revolution in transport happen. Many people say technologically, many things are feasible. From a legal point of view, however, it is a much bigger challenge.

So these three themes, autonomy, connectivity, and multimodal fusion, and the need for public and private cooperation, are some ideas I wanted to throw in the ring. I would like to start our round of panelists with Mr. Kogogin, whom I invite to share his view on the revolution in transport.

С. Когогин:

Спасибо, Николаус!

Хочу поблагодарить всех присутствующих в зале — всех, кто пришел поинтересоваться этой темой, которая нас, автопроизводителей, конечно, волнует. Мы не стоим на пороге революции в транспорте: эта революция уже совершается. Главный вопрос звучит так: готовы ли мы, при сегодняшнем уровне развития технологий, к созданию автономных транспортных средств?

Ответ однозначно положительный. Сегодня уже можно создавать автономные транспортные средства и связывать их в единую сеть, независимо от вида транспорта: воздушного, водного или наземного. Насколько это сегодня востребовано экономикой, людьми — другой вопрос, но борьба за снижение издержек, сокращение затрат времени, более удобные перевозки пассажиров и грузов приводит к тому, что каждый сантиметр, каждый доллар, каждая минута становятся все более важны для нас. Время сжимается, сегодняшняя жизнь требует от нас принципиально новых подходов. Я уверен, что цифры, названые Николаусом, реальны и изменения в транспортной сфере будут происходить очень быстро. По крайней мере, все производители транспортных средств к этому готовятся.

Но возникают вопросы внеэкономического характера: насколько люди готовы пользоваться такими транспортными средствами и насколько законодательная база различных стран дает возможность ими пользоваться? Решение этих вопросов займет больше времени, чем создание самого транспортного средства, потребует усилий от всех: частных компаний, правительств, общества в целом. Об этом надо говорить. Надо четко понимать, в какие сроки мы сможем изменить законодательство, сможем договориться — не в отдельных странах, а в мировом масштабе — о применении таких средств. Это непростой и долгий путь, но я уверен, что мы его пройдем.

Предпосылки к созданию таких средств — это в первую очередь, наверное, экономические соображения и необходимость сокращения временных затрат. Возьмем нашу страну. Она отличается только одним — огромными расстояниями. Логистические издержки в России всегда будут значительно выше, чем в Европе. Не думаю, что в ближайшие 15-20 лет дорожная инфраструктура существенно изменится: Алексей может со мной не согласиться, но тем не менее это так. Более эффективное использование существующей инфраструктуры позволит применять автономные транспортные средства. По нашим расчетам, рост объема грузоперевозок по нашим сегодняшним дорогам может составить от 60% до 80%, если мы запустим на них автономные транспортные средства.

Для российских производителей это очередной шанс. Из отстающих мы можем стать равноправными партнерами, потому что у нашей страны есть одна особенность: вряд ли мы сможем создавать «умные» дороги, как в Европе или США. Нам надо настраиваться на то, что дороги останутся такими же, как сейчас, — и из-за их сегодняшнего состояния, и из-за того, что, несмотря на развитие инфраструктуры, наши погодные условия все равно не позволят иметь разметку и нормальные дорожные знаки. Автомобиль должен сам адаптироваться к окружающей среде. Большое

значение этой проблемы для России дает нам возможность побороться за первенство в развитии этого нового вида транспорта.

N. Lang:

Thank you very much, Mr. Kogogin. It seems the key question here is really how we can fit the new means of transport into the existing world. That is probably one of the key challenges, and also the second point you mentioned. The fact that legal adaptations might take longer than technical evolution is a very important point.

I would now like to invite Mr. Bo Andersson, President of AVTOVAZ, to share a car manufacturer's perspective with us.

B. Andersson:

I would like to share three facts with you. If you take the Russian Federation today, we have roughly 240 cars per 1000 people. If you look at the rest of Europe, it is roughly 550. I am optimistic that people will buy more cars.

Secondly, if you look at the theme we are discussing today, we are an assembler. That means that seven times more money is spent on our suppliers than we spend in-house. On any given day, we produce 2,000 vehicles. We spend RUB 100 million on in-house costs, and we spend RUB 700 million every day on our suppliers. Perhaps the key element of the revolution in transport for us is, how this new infrastructure will help us have less inventory, and how this new infrastructure will help us to get the cars to our dealers faster.

We produce vehicles for Renault, for Nissan, for Datsun and for Lada. If I take a step back, inside Renault is an alliance of 46 plants worldwide. Six of them produce with Nissan on the same line. We are one of the six. Two of them produce Renault and Datsun vehicles at the same plant. We are one of those two. And only one produces four brands at the same plant.

Hence our concern is firstly the market, and secondly the complexity of being a car manufacturer; how to manage the supply chain. I think the technologies here can help us to do that in a smarter way, can help us to get the cars to the dealers in a faster way. Third is the thing that is most important to us today – navigation systems. Ten years ago, we did not have it in Russia. The Russian government has been very clear on GLONASS. It is difficult for us to implement it, but if we implement it right, it is going to be a huge advantage. It is also going to be important for the government and for the transportation industry.

I have a positive perspective on the market as such. Our primary focus is on how to integrate the total supply chain and serve the needs of the customers. We export to 28 countries. What I am not 100% sure of is, what technology is still to come. It may sound odd, but I am very happy to say that in the last one and a half years that I have been at AVTOVAZ, we have only had two recalls. People thanked me, saying that AVTOVAZ had never done a recall before; it means our quality assurance is working. Both recalls were related to mechanical issues. So there is also an advantage to having less complex electronics in the car from a safety point of view.

N. Lang:

Thank you very much, Mr. Andersson. I did not know that you are the most flexible plant in the whole Nissan network. I think it is also important to point out that this is happening today in Russia. Thank you very much.

Mr. Tsydenov, we have heard from two key players in Russia, from the passenger car perspective and the truck perspective. In both, we also heard about the importance of the government and the legal framework. We are thus very curious to have your perspective on that.

А. Цыденов:

Спасибо, Николаус! Спасибо, уважаемые коллеги, уважаемые гости!

Действительно, в России ведется большая работа по созданию современных информационных систем на транспорте. Один из реализованных проектов — система экстренного реагирования при авариях «ЭРА-ГЛОНАСС».

Кратко расскажу о ней. Автомобиль оборудуется терминалом, который в случае его попадания в аварию автоматически передает в диспетчерскую службу аварийный сигнал, указывающий, где произошла авария и какая машина в нее попала. Автоматически устанавливается голосовое соединение с экстренными службами. Такая система уже запущена и работает, сейчас идет сертификация новых транспортных средств, чтобы можно было выпустить их на рынок. По нашим оценкам, в следующем году таких машин будет около 300 тысяч, в 2017 году — около полутора миллионов, затем число транспортных средств, оборудованных терминалами «ЭРА-ГЛОНАСС», будет увеличиваться на 2,5 миллиона в год. Система позволяет не только экстренно реагировать и оказывать помощь при авариях, но и предоставлять дополнительные услуги.

В дополнение к этому мы приступили к созданию государственной информационной системы навигации на автомобильных дорогах, которая очень важна. Фактически это электронная карта всех дорог. Таких карт много, свои карты есть у Google и у «Яндекса». В чем отличие государственной информационной системы? Во-первых, она имеет юридическую значимость. Во-вторых, государство несет ответственность за точность координат. Формирование такой электронной карты автомобильных дорог позволяет затем выпускать автоматизированные транспортные средства, которые в навигационном отношении будут четко привязаны к дороге. Не будет погрешности плюс-минус 15 метров, как сейчас: кто ездил по навигатору, тот понимает, что это такое, когда навигатор перекидывает вас слева направо. Здесь вы будете четко привязаны к дороге, с сантиметровой точностью. Система будет содержать

также информацию о сервисе: о заправках, медицинских пунктах, предприятиях питания — обо всем, что может потребоваться пользователю на дороге.

Сейчас также ведется работа по созданию высокоточного навигационного поля. Производится установка контрольно-корректирующих станций, которые позволяют добиться сантиметровой точности навигационного сигнала ГЛОНАСС. Сейчас и ГЛОНАСС, и GPS имеют примерно равную точность — порядка 10 метров. При установке корректирующих станций навигационная точность, повторяю, повысится до нескольких сантиметров. Эта работа практически завершена пока лишь на внутренних водных путях. Мы только сейчас приступили к покрытию автомобильных дорог. Согласно программе создания коридоров «Север—Юг» и «Запад—Восток», субъектам Российской Федерации предоставляются субсидии, в том числе на установку станций, обеспечивающих высокоточное позиционирование.

Предусмотрены также мероприятия по интеграции контрольно-корректирующих станций, принадлежащих разным собственникам, в единое высокоточное поле. Станции устанавливаются вдоль рек, в аэропортах, на железных дорогах, на предприятиях различных форм собственности, в субъектах Российской Федерации. Получилось так, что одни и те же территории перекрыты несколькими полями, и мы приступили к интеграции этих полей.

Еще раз повторю: электронно-цифровая карта дорог с ответственным позиционированием и ответственной координатной привязкой плюс высокоточное поле — это условие, которое позволит в будущем запустить новые виды транспорта, не нуждающихся в водителе. Автобус без водителя, который едет по установленному маршруту, — это проект, который реализуется уже в настоящее время.

Если говорить о системе «ЭРА-ГЛОНАСС», то мы создали такую систему первыми в мире. Аналогичные проекты реализуются в США, в Европе, в

Бразилии, но все они находятся в стадии разработки или опытной эксплуатации. У нас создана вся необходимая юридическая база: есть специальный закон, технический регламент Таможенного союза, подзаконные акты. Наличие такого успешного опыта вселяет в нас уверенность, что и другие проекты, о которых я упомянул: ГИСНАТ, высокоточка и прочие — будут доведены до конца. При этом для повышения эффективности всех систем разработан вариант государственно-частного партнерства, о котором уже говорилось: для эксплуатации системы «ЭРА-ГЛОНАСС» специально создано ОАО «ГЛОНАСС». Под него разработан специальный закон. Уже сформирован совет директоров, членом которого, в частности, является уважаемый Бу Андерссон. ОАО «ГЛОНАСС» будет эксплуатировать систему «ЭРА-ГЛОНАСС», внедрять в нее дополнительные сервисы, обеспечивать привлечение частных инвестиций к развитию инфраструктуры этой системы.

Фактически мы переходим к созданию интеллектуальных транспортных систем. Под эгидой Министерства транспорта создается автоматизированная система управления транспортным комплексом, в которую входят не только «ЭРА-ГЛОНАСС» и электронные карты, о которых я говорил, но и другие сервисы и комплексы. Создается единое информационное поле с разными уровнями доступа: для профессиональных пользователей, для частных лиц, для водителей. В итоге появится обширный сервис, обеспечивающий безопасность движения, позволяющий сократить расстояние поездки, выбрать оптимальный маршрут, получить информацию об услугах на пути следования и имеющий много других составляющих.

Часть пути мы прошли, и, думаю, мы дойдем до конца. Чем больше у нас появится по пути участников и партнеров, тем лучше.

N. Lang:

Thank you very much. That is a great example of a much needed digital infrastructure. I think what you have just mentioned, the high-precision maps, are an absolute prerequisite to make autonomous driving a reality. It is very interesting to see how this has evolved.

I would like to turn to Mr. Valentin Gapanovich now, to represent a third transport mode. I would call it a very old transport mode, a very traditional mode, but one which has also been shown in the video as one that can go up to 400 kilometres per hour: railway transport. Mr. Gapanovich, we are very curious to hear your views on the revolution in transport.

В. Гапанович:

Мой близкий товарищ, Сергей Когогин, начал свое выступление с рассказа об автономных транспортных средствах. Сложно себе представить, что высокоскоростные или грузовые поезда будут работать в автономном режиме. В будущем, наверное, да. В метро это уже есть. Сегодня это делается также на путях общего пользования в Америке и Европе. В России это маловероятно в ближайшие десятилетия, но тем, кто приехал из Москвы в Санкт-Петербург поездом «Сапсан», скажу — большой тайны здесь нет, — что машинист просто сидел в кабине. Если бы вы вошли в кабину «Сапсана», то увидели бы, что машинист при отправлении из Москвы нажал одну кнопку, а по прибытии в Санкт-Петербург — еще одну, и всё. Поезд «Сапсан» ведется на 100% в автоматическом режиме. Машинист наблюдает за процессом и в непредвиденных ситуациях выполняет возложенные на него обязанности по остановке поезда.

Те, кто присутствовал на Олимпийских играх в Сочи или бывают в этом прекрасном городе и поднимаются из Адлера на Красную Поляну (станция называется Эсто-Садок), наверное, не знают, что поезда «Ласточка» работают на 100% в режиме автомашиниста. Машинист наблюдает за

процессом, а управление движением поездов на этом перегоне выполняется в автоматическом режиме. Мы освоили эти технологии — не скажу, что первыми в мире, но одними из первых. Наши зарубежные партнеры: представители Siemens, Alstom и других компаний — подтверждают это.

Но я хотел бы во все это, как говорится, добавить ложку дегтя. Интернет — важнейшее средство общения между людьми, без которого невозможно представить сегодняшний мир. Но все мы хорошо знаем, что научно-технический прогресс несет также и риски, и вызовы. Какие технологические вызовы связаны с Интернетом как средством передачи информации? Наши зарубежные партнеры-железнодорожники широко внедряют стандарт 4G LTE: это происходит и в Европе, и в России. В то же время в Европе, как и в Америке, и в Китае, имеется система управления движением поездов, основанная на том же стандарте, что и у нас, — GSM-R. Что произошло недавно? Стандарт 4G LTE вступил в конфликт со стандартом GSM-R, и в итоге мы либо останавливаем все поезда, либо прекращаем внедрять стандарт 4G LTE. Речь идет о проблемах, связанных с электромагнитной совместимостью: они уже существуют и будут существовать в ближайшее время.

Далее, это вопрос так называемой кибербезопасности — мы говорим «киберзащищенность». Ни для кого не является секретом, что я могу вот с этого персонального коммуникатора войти в любой автомобиль, оборудованный любой навигационной системой и сделать с этим автомобилем что угодно. Это вызов? Конечно, вызов. Защищают ли нас сегодня в полном объеме системы кодирования и другие системы, получившие распространение в последнее время, в том числе в России, и призванные обеспечить киберзащищенность автоматизированных систем управления? Нет, уважаемые коллеги. Мы находимся в самом начале этого

пути. Это вызов, это риски, которые нужно учитывать при создании систем управления, систем мониторинга, всех систем.

Есть ли выход? Конечно, есть, но этим нужно заниматься уже сегодня. Это очень дорогое удовольствие, специалистов в данной области довольно мало. Всем этим занимаются не только железнодорожники: все это нужно учитывать нашим коллегам, которые разворачивают цифровые пространства и, самое главное, автономные и неавтономные подвижные системы, управляемые с помощью удаленного доступа. Для доставки управляющих команд используются открытые сети связи, открытый Интернет.

Наверное, можно было рассказать еще много интересного. Я лишь обозначил те вызовы, которые всегда возникали и будут возникать в связи с научно-техническим прогрессом.

N. Lang:

Thank you very much. The topic of cyber security, and especially also the topic of conflicting communication modes, is one of the big-risk challenges, together with the legal framework. Staying in the world of rail and railways now, I would like to hand over to Mr. John Wories to talk about the future trends he is perceiving. We have talked about Smart Trucks, we have talked about Smart Cars. What will the ‘smart’ trend of the future look like in transport, and how would your company fit it into this multimodal fusion?

J. Wories:

Thank you, Mr. Chairman. I would like to just give you a brief overview of our company first, who Amsted Rail is. Then I would like to talk about our activities in terms of health monitoring, focusing on the freight car. I think it is important to distinguish that this is the sphere of influence that we enjoy, as well as the

activity that we are working on. Lastly, I would like to give our perspective on what we believe is coming in the future.

First, about Amsted Rail. We are the leading manufacturer of freight car truck components and end-of-car devices in the United States. For everything underneath the freight car, we are actively involved in either manufacturing or partnering on making those parts. We are employee-owned and we have about 7,000 employees. We have activities, joint ventures and manufacturing on six continents. We have been in business for over 100 years, but as my colleague will share, we are technologically behind, even though we have many years in this industry.

Amsted Rail has been partnering in Russia since 2006 and is dedicated to localizing activities within the countries where we do business, including transferring our technology to Russian partners, sharing manufacturing processes and creating joint ventures. Our flagship investment here in Russia is EPK Brenco, which manufactures railway bearings for Russia's new-generation, 25-ton axle railcar fleet. I am proud to mention that this investment will soon be exporting bearings to the global market. Even given the recent microeconomic challenges, working with our partners we have been able to take the quality and the production and redeploy them.

We have been pouring steel for over 100 years, and I am pleased to share our company vision with you. We want to be able to make the railroad safer and more efficient, increase cargo turnover, reduce congestion on railroad networks and allow freight trains to operate at higher speeds. We use a rule of thumb in the United States within our business: every one mile per hour that the railroads have to go slower can mean 10,000 additional freight cars required to move the same amount of freight, so it is a major impact on them. As we take a look at the technology, the traditional freight car is a 'dumb asset', in relatively terms. It does not have any power, it deals with extreme vibrations, extreme temperatures, and

gives very little predictive information to the operators as they work on the health and status of what they are hauling.

What we are working on now, with our technology partners, is to remotely monitor the critical aspects of the freight car's status – its performance bearing on temperatures, dealing with lading damages, some of the braking statuses and the payload that is going within any given transaction as the freight car moves across rails.

Going forward, we are deploying sensors and software to determine the integrity of almost every part underneath the freight car, which we are also actively manufacturing. It is a unique closed-loop opportunity for the parts that we manufacture. We are able to gather the data in the field, in service, not at a test lab, not in a laboratory environment. We are able to monitor what we are manufacturing and then go back to the design board and improve those products, so that they can last longer and be a safer product as the railroad moves its production.

As far as the future is concerned, we have been focusing mostly on that effort. We have about 18,000 devices deployed in any one of these categories – accelerometers, temperature bearings, and more. However, we have now moved some of the focus onto a separate subgroup that is looking at inter-train dynamics and communication with the locomotive, to give that status update in real-time, as opposed to after a derailment or after a bearing burns off. We feel that is imminent. It is a matter of the next several years for that to be in place. There are devices, such as electronic control of the braking system, taking place with our partners in the field. We feel it would also be a gateway into much of the technology that is taking place on the freight car. Thank you.

N. Lang:

Thank you very much. So this is one aspect of the future – preventive maintenance and repair on the railways as a further way of optimization. Let me

turn to Mr. Christian Morales and the perspective by Intel on the revolution in transport – the backbone of this revolution, the systems, the backends; what is needed to make it all happen.

C. Morales:

Thank you sincerely for inviting me to be on this panel. I started at Intel in the early 1980s, working on the automotive account. That was my first work as an application engineer. I remember going to the automotive manufacturers with our microprocessors, and they would say the quality of what can be done with the microprocessors is not good enough; to come back later. So we came back a year later, two years later. And then we did the injection systems, exhaust gas systems, automatic gearboxes, and dashboards. They introduced a lot of improvement into the experience we could have in a car, in terms of the energy consumption of the car.

Since then, we have seen a variety of applications taking place. A car, that had a lot of embedded autonomous applications, became connected to the Internet, and now connected to the Cloud. That is why now we call a car a 'connected device', an Internet of Things future mobile device, with five to fifteen million lines of code. Quite complex. When you drive a car, you cannot do a reset: it has got to work. Everything has got to work well.

What we see now is the usage of the Cloud, of Big Data, and of analytics. All of this has to be integrated. The same applies to the Smart City concept, and also in how energy is optimized from production to distribution to consumption. When you look at all the very important challenges we have, when you look at climate change, when you look at the environment, when you look at the cities – if we can integrate all of those technologies, all of those capabilities, then we can have an ecosystem that works towards the same objective. Imagine five years from now, we might be coming from the airport and can predict exactly how long we will need to reach our hotel, for example, driving in our car, compared to today

when one cannot be sure exactly how long the journey will take due to variable congestion on the roads.

Using all those technologies and all those services there, we will also see a major simplification of all the electronics used in cars today. We are going to see more Internet-connected trains. On Monday morning, I was at an airshow in Paris. Many of the planes, some of which have had microprocessors now for 25 years, had a lot of new applications coming in. Everything is becoming mobile, everything has become part of the Internet of Things. Usage of all those new technologies and the support capabilities from the Cloud, the Internet, data centres, and so forth, make it possible.

N. Lang:

Thank you very much. I think one very important point which came up is the fact that the ‘connected car’ will connect into a mega-city traffic management centre. I think we looked at the benefit that optimized traffic management can bring, in Moscow, in Rio, in Hong Kong. Despite the cost, mega-city traffic management is something that actually is a positive business case for every city with more than two million inhabitants. That is a potential that connected cars will have in future.

Let me turn to Mr. Thiele, and ask him to share his views. He has looked at the industry for many decades, and has seen a lot of trends come and go. We would be very curious to have your point of view, Mr. Thiele.

H. Thiele:

Thank you very much, Mr. Chairman. It is a pleasure to be here, ladies and gentlemen, for this late afternoon discussion on a very important topic. We have to look at all of its aspects to try and make a prediction of where we are going. I am the Chairman of Knorr-Bremse Group, and we specialize in braking systems. Globally, we employ about 25,000 people, of which more than 3,000 are engineers. We look at all aspects of braking, as well as a lot of peripheral items.

We cover any installation, anywhere in the world, for locomotives, for wagons, for cars, for metropolitan transport, suburban trains, tramways, and more.

We are also quite active here in Russia. For many years, we have had a production plant in Russia. We plan to stay for a long time to come, despite the situation which we are experiencing right now, because we will overcome that problem. Our sales will be in the range of EUR 6 billion this year in both categories, for rail and for trucks.

Regarding this autonomous driving development, I am very impressed by the progress made in the recent past. There is no doubt about the advantages, and Mr. Lang has already mentioned some of them. I agree with all of them and would only like to add that we should also look at the comfort area. Comfort is substantially improved by autonomous driving. In principle, the system is here. It has enormous advantages, no doubt, but what are we going to do now? Daimler has shown a fantastic example. With Daimler trucks, you can also go on public roads. At the moment only in Nevada, however, which probably gives you a good idea of the framework activity needed to introduce this technology. It works, though it needs more sophistication than we have right now.

We have a system therefore, but it must be more sensible. We cannot have a system, medium or long-term, which only brings the truck, car or train to a stop if something fails, if something does not work well. We need more sophisticated software; there will be a tremendous effort in the future to get that done.

My question concerns the factors that may play an even more important role than creating technology. I am concerned about the regulators. Look at this globally applicable system, with enormous advantages for economies and for the people. For this to be introduced, you need to convince the regulators, the lawyers, the insurance organizations. This applies worldwide.

I would like to make a suggestion. What we need here, in addition to technology, penetration of the different areas, and overcoming obstacles, is a shield of global political support. It is not in the same order as, for instance, environmental

issues, which are handled in meetings with global leaders. But it is an issue which is coming close to that. It has an enormous importance to the people and to the societies of the future. We need to go global on support and on principles. How are we going to attack an issue and make it happen?

I can give you one example from my country, which is not very encouraging though. For many years now, in Germany, everyone in the transport industry has been promoting the so-called ‘long truck’ – 30 metres long, weighing 40 tons. Instead of having three trucks, we can do the job with two trucks. In Germany, you have to go to the different regional administrations and convince them that they should allow that. There are some regions that say it is a nice idea, but most of them say no, that is too big for them, they do not want that. So it is not just a question of arguments. It is the political will to follow different rules, not only in technology, but also in politics in general. As we have experienced right now, it is not always reasonable what politicians are doing.

That will be the big issue. It can be assumed that within the next 10 years, it will not be possible to cover all aspects of autonomous driving in the truck and car industry, if you do not have the regulators behind you. All of this will take more time, and that is my biggest concern. What can we do? One tool could be to make it a global approach. I do hope that we will join globally to identify the opportunities which such a system creates, and the advantages it gives to the economy and to the people. What we are seeing today is only the beginning of the road. We are only just heading out. There will be a lot obstacles which we will have to overcome. Thank you.

N. Lang:

Thank you very much, Mr. Thiele. I would like to ask Mr. Iho to share with us the view of the fourth transport mode, which we have not touched on so far – the aeroplane.

V. Iho:

Thank you, Mr. Chairman. A great outlook. I have to say, even though I represent aviation, I love cars and trains and all of the other transport modes. But aviation for me is pure rock'n'roll – it is really great!

I would say that aviation is the most advanced mode of transport available today. Ironically, the idea of 'autonomous driving' is a very old innovation within aviation. Autopilot has existed for years. Perhaps I could challenge the rest of the transport modes and the panelists with a description: my description of the four stages where I see the revolution in transport developing in my industry.

The first stage is obviously technology-driven. It focuses on a single transport need, from A to B, for example. You have a technology, you have an aircraft, and you fly people and you keep on improving on that. So there will be more efficiency, there will be fewer emissions. You continue improving the system environment around that. In aviation, that could be the ATC services.

But then you have to have a second layer, which is a kind of global enabler for the global integration of the network. Another relatively old innovation in aviation. This requires a global distribution network, a TDSs. They have been in aviation for around 30 years. This has enabled people to connect between different service providers, between different airlines, so that you can go from A to B and continue to C using different service providers. That improves efficiency and it improves capacity utilization. Take my airline, for example. We fly our long-haul aircraft for just over 16 hours a day; the passenger load factor is somewhere around 90%. Compare that to, for example, private cars, and you will see how much unused capacity there is available for transporting people.

The third phase of this revolution or evolution is creating additional services, and also creating global distribution, as well as a commercial layer for selling and distributing those. You need to have global distribution for additional services, so that consumers can differentiate the product, so that they can have full transparency. This motivates us to keep developing our services further. Right

now we are in the middle of that phase, but it is not where we should be, in my opinion.

The fourth phase will be a connection between different networks, not only in aviation but in other transport modes. That is starting to emerge. However, the efficiency of that is not where it should be. I shall give you an example. Yesterday I travelled from Helsinki by train, on the Allegra, which is very convenient. We actually offer a service whereby you can travel on the Allegra to Helsinki and continue with our airline to Europe or Asia on the one ticket. But so far, even though the service has been available for more than half a year, only five tickets have been sold. So the penetration is not what it ought to be, but it still serves up a lot of potential, and the fourth phase is about to emerge. Thank you.

N. Lang:

Thank you very much. Those five tickets are a monumental number. We are still a long way away from multimodal fusion. Mr. Thiele, you mentioned the famous unmanned track that goes through Nevada. I also had the privilege to be at the CSS in January to see the F015.

Dr. Zeeb, I think you are the one man behind all this magic. We are very fortunate to have you here. If you could share with us your perspective, that would be much appreciated.

E. Zeeb:

I would like to go back a little bit to the technology of the cars, and would like to underline what Mr. Kogogin has already mentioned. Autonomy in cars is not a revolution at the moment; maybe it is more of an evolution, that has been taking place over the past 20 years. Twenty years ago, we introduced driving systems, based on sensors and based on computation power inside the car. Over the last 20 years, cars have improved significantly. Cars today are able to brake by themselves. They help their drivers to brake in the correct way, and they also

have improved the comfort of driving. If you drive a modern car at the moment, you can in principle drive on a highway without doing very much at all. The car keeps to the lane, it keeps a distance from the car in front of you, and it keeps its speed, of course; all autonomously.

Still the driver has to remain alert and focus on the road. Within this decade, I think, we will have cars on the road that will drive themselves in special situations, in highways and traffic jams or whatever. They will be equipped with somewhat better sensors and retail for the same price as cars today. The driver will be able to take his focus of the road and make phone calls, for example, and not have to worry about driving. Yet we still need the driver in the car, because I do not think that within five years we will have the technology at an affordable price, so that the car can drive anywhere it wants. Inner-city traffic is still the ultimate challenge for autonomous driving.

So that could be a revolution. If we had more money to spend on sensors, if we could install more sensors than today, then we would actually be able to have a driverless car. We demonstrated this two years ago by driving between two cities in Germany in a car without a driver, by letting the car use all the sensors we had installed. We used more sensors in that test model than we have to use in this system at the moment. Still, it is a challenge to do this in a safe way all the time. However, here are some business models that could generate the kind of funding we need. Car sharing, for example, is one, or as already mentioned, truck manufacturers. The car could drive by itself to the customer, if it is a shared car, or the truck can drive on a logistics yard without a driver. In perhaps 10 to 20 years, these two branches will merge and then we will see a technology where a car can be driven by a driver or drive on its own. For now, we do not need a special infrastructure for our cars, but if that existed it would make things even easier. Perhaps we ought to plan that as well.

N. Lang:

Thank you very much. Some very important points there, on vehicle-to-vehicle and vehicle-to-infrastructure communication, which will be one of the fundamentals for making autonomous driving a success.

Last but not least, Mr. Ortner. We spoke before the meeting about the importance of an integration of the supply chain, in particular as your company is a key player in creating equipment for moving goods in transport. I would be very interested to hear your view on the future of an integrated supply chain.

H. Ortner:

Thank you very much, Mr. Chairman, it is a pleasure to be here. Thank you for the invitation. Allow me briefly introduce PALFINGER, our company. We are a global market leader for load handling equipment. We operate approximately 40 factories and have around 10,000 employees. Russia is a very important market for us and we operate in three factories here in Russia, with 2,000 employees. We have transferred all production from our locations in Western Europe to Russia, to be autonomous in Russia. We believe, that we can only be successful in Russia if we become a Russian company.

We produce load handling equipment, as I mentioned. Wherever people or goods are loaded or unloaded, we deliver product or products required for this. We produce one important component for the supply chain, but it is only one component. All we have done so far has been to optimize the load handling product. We spend a lot of money on R&D, in production, to optimize our product, to make it more productive, to make it easier to handle, to make it safer, and to make it cost efficient. Yet, what will be the real revolution? All our activities so far have been to optimize our product. It is also what all my colleagues have been doing, whether they are producers of trucks or cars or railway carriers, or if they are software providers – all our efforts have been to improve our systems.

Let us change perspective for one minute and switch to using the eyes of the customer. The customer is not interested in the product or the technology. He is only interested in a solution. He has a problem: he would like to transport something from A to B. So he needs a solution for this problem. He does not need a car, nor a truck, nor does he need load handling equipment. He needs a solution. The best solution to do this job in the fastest time, greatest efficiency, and at the lowest cost. If we continue to optimize our part in the supply chain, then that is one step in the evolution.

The only way to go forward is to combine our objectives in a system. We have to open up our technology and combine it with the technology of the truck manufacturer, and of the car manufacturer. Only in a combined solution can we offer a better solution for the end customer. It is that simple. It is easier for us to cooperate when we speak about sales and service. We all know that 100% of the productivity of the system, and approximately 60% to 70% of the cost of a system is defined in the R&D process. My approach is that we create partnerships with the other parts in the logistics chain, in the supply chain, based on R&D.

If we develop interdisciplinary R&D concepts, then we can create a revolution in transport, because then we can improve the entire system and not only improve one part of it. We all know it is very difficult to establish R&D partnerships between different OEMs, but I believe it is the only way we can improve the entire system, rather than only have partial improvement of one component and then the other, and so on.

N. Lang:

Thank you very much. That is a very specific view on multimodal fusion looking ahead. Ladies and gentlemen, I think we have had a fascinating discussion around this panel, really bringing together all the transport modes. We are only missing bikes, but we have rail, we have cars, we have trucks, and we have planes, here in this group. We have had a discussion about the finished product,

such as cars and trucks, but also about the mechanical components, the digital systems, and the backend systems.

Before I give the Q&A to the floor, because I have already seen a few hands, I would like to have a brief discussion with perhaps Mr. Kogogin, Mr. Andersson, and Mr. Gapanovich. Please tell us very briefly, if you had one request to the State, or the public authorities, to make the revolution happen, what would this one request be? Then I would like Mr. Tsydenov to build on that, if you would be so kind. Mr. Kogogin, if you had one wish in this regard, what would it be?

С. Когогин:

Николаус, все, кто здесь собрался, сидят и рассуждают о том, что человек в кабине транспортного средства уже не понадобится.

Каждый из нас сказал: может быть, но есть проблемы. Для появления у всех нас уверенности в том, что это решаемые проблемы, наверное, необходимо взаимодействие бизнеса и власти. Просить власть нужно только об одном — о разработке пакета законов, который позволит протекать процессу автоматизации на транспорте естественным образом. Если мы сделаем это вместе с властью — я подчеркиваю: вместе с ней, — тогда произойдет то, что должно произойти.

Я не беру остальные транспортные средства. Лично я считаю, что самолет — самое совершенное транспортное средство, потому что работал в авиации, но вообще-то мир изменило именно появление автомобиля. Сейчас наступает этап, на котором технологии снова позволят изменить мир, и обязательно в лучшую сторону, но для этого нужно будет поработать всем: и бизнесу, и власти. Для этого и нужно частно-государственное партнерство — для того, чтобы разработать все регламенты и создать нормативную базу. Задача власти — принимать законы, которые будут не тормозить развитие транспортной отрасли, а способствовать ему.

И еще одна задача: общество должно принять все это. Если люди будут отторгать новшества, бояться их, у нас вряд ли что-то получится. Должно произойти то же, что с электронными гаджетами, которыми сегодня пользуются все.

N. Lang:

Thank you. Mr. Andersson, what would be your wish?

B. Andersson:

Having worked in many countries, I would say that what I see from the Russian government is that they are very responsive to the transportation industry. I think my wish would be to implement the GLONASS system 100%, and to make it compatible with the European system. This would be a big step forward, and I hope that we all can do that.

N. Lang:

Thank you. Mr. Gapanovich.

В. Гапанович:

Я не могу задать вопрос государству. Государство — это уважаемые заместители министров, которые присутствуют здесь. Наша компания — на 100% государственная. Как я могу задать здесь этот вопрос?

Приведу небольшой пример тесного взаимодействия общества, государства и бизнеса в сфере стандартизации. Я возглавляю межгосударственный комитет МТК 524, который занимается стандартизацией на железнодорожном транспорте. За последние несколько лет мы приняли около 300 межгосударственных стандартов в области железнодорожного транспорта. Что такое стандарты? Когда я беру наушники, они вставляются в любой телефон. С другой стороны, есть

гнездо для зарядного устройства, которое у каждого телефона и коммуникатора свое. Общество говорит государству, что нужен один стандарт для наушников и зарядного устройства, независимо от телефона, бизнес в лице какого-нибудь технического комитета разрабатывает эти стандарты, и в итоге наушники одни, зарядка одна — вот что я понимаю под стандартизацией. Эффект для общества и для бизнеса положительный. Но это работает не всегда. Будем стараться делать так, чтобы это работало.

N. Lang:

Yes, setting standards is a key point. Mr. Tsydenov, would you like to give your reaction to this wish list you heard? A request for a brief reaction, please.

А. Цыденов:

Постараюсь ответить сразу на все замечания.

Прежде всего, необходимо доверие общества к новым технологиям. Представители государственных органов — тоже члены общества, нормативные документы формируются на основе уже возникшего доверия. Мы со своей стороны — за себя я точно могу ручаться — готовы к внедрению новых технологий, систем управления без водителя и иных систем при соблюдении определенных норм и правил.

Тут мы переходим к вопросу норм и стандартизации. Если мы четко пропишем эти правила и стандарты, если все будут понимать, как их применять, если все участники движения — автомобильного, железнодорожного, любого — будут руководствоваться установленными нормами и правилами, тогда новые технологии, безусловно, могут внедряться.

Еще немного о ГЛОНАССе, о котором говорил и Бу Андерссон. Для авиации мы разработали технологии, которые позволяют автопилоту не только доводить самолет до аэропорта, но и обеспечивать посадку. Мы

отработали технологию ГЛОНАСС в Антарктике, на Южном полюсе, когда в условиях плохой видимости — менее 60 метров — самолет по системам автоматического ведения, по ГЛОНАССу, садился на 500-метровую полосу на льду. Это работает, и уже не первый год.

И еще раз о законодательстве. Мы действуем с опережением. Мы написали закон — на днях он был внесен в Правительство — закон о прямых комбинированных перевозках, устанавливающий порядок взаимодействия, наступления ответственности и так далее для всех видов транспорта и различных перевозчиков. После принятия этого закона можно будет продавать на весь путь следования не пять разных билетов: один на автобус, другой на поезд, третий на самолет, четвертый, скажем, на лошадь, — а один, действующий от точки отправления до точки назначения. В законе уже указаны технологии, ответственность, обязанности и все прочее. Он будет опережать действующую нормативную базу и создаст законодательную основу для единых мультимодальных перевозок.

N. Lang:

Thank you very much, thank you. I would like to use the last five to ten minutes to open the floor to questions from the audience.

From the audience:

Thank you. We have seen there are many benefits. How big are the benefits of autonomous transportation for Russia? We are a very peculiar country with enormous distances, so the benefits could be very significant indeed. But we face a lot of challenges in this respect – there is snow melt in April, and many obstacles on the road. So how can we be at the forefront of this development?

N. Lang:

Would you like me to answer? Or shall I ask Dr. Zeeb, from a technical point of view maybe, to answer? Very often the question arises of how do we handle autonomous cars when a blizzard starts or when a snowstorm starts. Dr. Zeeb, perhaps you can give us a technical perspective?

E. Zeeb:

That is a really good question, and it puts me on the spot. It will be difficult. In fact, the first autonomous cars will not be able to drive in bad weather conditions, so that is that. What we need are better sensors. Sensors which also work in winter. If we have a good global positioning system, of course, we do not have to rely on the lines on the street. But current technology is really based on the sensors which are onboard the car. If you cannot see anything, an optical system also cannot see anything, making autonomous driving impossible. The next step would be to improve the sensors and to have infrastructure which communicates with the car. That might be the solution.

N. Lang:

Which takes us back to the point, that we are still some way away from a fully driverless car, because, for example, there are common meteorological conditions where the driver has to take over the steering wheel again.

E. Zeeb:

Those are the two branches I described. A driverless car only in a very protected area. The first step is in parking lots, maybe stacking yards. A completely driverless car, which runs everywhere and in any weather conditions, is in the distant future.

N. Lang:

Thank you very much, thank you. Any other questions? There was a question here.

C. Bach:

Thank you very much. My name is Christian Bach, and I am the Executive Secretary of UNECE Economic Commission for Europe; we host all 58 of the UN Transport conventions. I have more of a comment. There has been a unanimous call for regulations and standards. The biggest barrier is perhaps a lack of standards in the respective countries or regions, the fact that each creates their own standards and regulations. They are all based on the principle that there is a driver behind the wheel, so all of those standards and regulations have to be changed. We host the World Forum for Vehicle Regulations. If you look in your cars and your vehicles, you will find an E number. The E number stands for Economic Commission for Europe. It is a UN organization, and we set all the standards for cars, including all brakes, autonomous brakes, energy consumption as well as autonomous cars.

They have to be constantly updated to ensure that we have global standards. If not, an intelligent car cannot talk to another car if it crosses a border. On multimodal transportation systems, we have the tier system. It is also a convention with us. If you look at the back of the truck, the tier is there. We are now doing the ETS system. That will revolutionize transport, because then you can see the container, you can take multimodal, you can do it on a truck, you can put it in a train. You can do it on a ship and you can just go through without having to declare customs at every single border you pass.

Finally, on railways, we are right now negotiating a unified railway law in the Eurasian context. We cannot solve the physical problem, the gauge problem, but we can solve the legal problem. That is perhaps the biggest barrier today, to really have rail transport going in the Eurasian context, because the legal

framework is not ready for it. There are all the liability and insurance issues that have to be solved, and that applies to all our conventions.

I would therefore like for the following to happen: I would like an intelligent autonomous multimodal transport system to happen. Come to Geneva and help us to create the necessary regulations and the standards, and the international framework that can allow it to happen. Thank you very much.

N. Lang:

Thank you very much. I think the Vienna Convention you mentioned, and many others, are definitely some stumbling blocks in the development here. Any last questions in the room?

I would like to thank our distinguished panel very much for the variety of perspectives presented. We started with multimodal, and we really had a rare breadth of perspective. Maybe I can leave you with this take-home message, the 90, 60, 30: 90% fewer accidents, 60% higher throughput, 30% less CO_2. I think they are big numbers that are worth fighting for.

I hope that you enjoyed this hour with us, and I wish you all the best at the Forum. Thank you very much.