

ПЕТЕРБУРГСКИЙ МЕЖДУНАРОДНЫЙ ЭКОНОМИЧЕСКИЙ ФОРУМ

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**ДИРК АЛБОРН, ГЛАВНЫЙ ИСПОЛНИТЕЛЬНЫЙ ДИРЕКТОР,
HYPERLOOP TRANSPORTATION TECHNOLOGIES
НОВЫЕ ТРАНСПОРТНЫЕ ТЕХНОЛОГИИ**

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Модератор:
Джефф Катмор, Телеведущий, CNBC

G. Cutmore:

Ladies and gentlemen, a very warm welcome to our session here to talk about Hyperloop and new technology, and the environment we are in and whether it is conducive to this kind of transportation system. And I am very pleased to introduce to you Dirk Ahlborn. He comes to us from Hyperloop Transportation Technologies, but you all know that because you have made the effort to come here this evening and listen to him speak. So thank you very much for being here. What I would like to do is at some point bring you in if you have a question you would like to ask, hopefully there will be an opportunity later on in the conversation. If you would like to ask a question, when I invite you to come in, please raise your hand clearly and then we can get someone to take a microphone to you and then hopefully we can smoothly proceed with the Q&A segment.

We are going to show you hopefully a little bit of tape, which explains the technology around this transportation system and tells you a little bit more about what others have said about the technology and about the opportunity going forward. But Dirk, I thought it might be good if we just started really with the general question about the technology environment and whether we have a fertile time for governments and private enterprise to spend large amounts of money on new technologies like this. We have clearly seen the success of disruptive business models like Uber and Airbnb and so on and so forth, but instead of what many of them do, which is to leverage off things that already exist, and offer it using technology in a different way, you are talking about building a whole new transportation system. So if I could ask you, is this the right time for a startup in the new transportation space, and if so, why?

D. Ahlborn:

I mean, personally I am very excited about what is happening in transportation, there is so much innovation happening right now. When we think about self-

driving cars, etc. So right now I guess it is sexy to work in transportation, which it did not use to be. So yeah, definitely the time is the right one, but I also believe that you make the time to become the right one. So we started three years ago, and everything started with basically an idea coming from Elon Musk, and he said, "Well, I think someone should do this, I cannot do it, I am too busy with Tesla and SpaceX". So we picked it up, looked at it and looked at the history, because at the end tube travel is nothing new, it has been around for quite some time. Actually, I think the first time it was mentioned was in a book from Jules Verne's son, already in the 1800's, in 1870 there was a first project in New York, so it was a pneumatic subway. The goal was to connect New York and San Francisco, they actually built the station, they built an initial track. It never made it to San Francisco, but maybe it was a little bit too early. The first patent for a train inside a vacuum dates back to 1904. And then after that in America we had two projects in the 1960's, where they were trying to make tube travel a reality. We had a project in Switzerland called Swissmetro where they were creating tunnels on the ground, low pressure environment, – so, very similar to what we are doing but with maglev trains, so complete trains. When we looked at all of these endeavors, and let us not forget the jettisons and the samsons, right, Futurama... But when we looked at all these endeavors, we realized that all of these failed because they were depending on one country. They were depending on one company. So it really was necessary to create a movement. So we set out to do just that. We started a movement. At that time, I was part of a non-profit incubator that was funded by NASA, and we were actually working on a new way of building companies. So if you think about the fact that we do everything online, you get your groceries online, you get dry cleaning online, you find your boyfriend/girlfriend online, in America you can even get divorced online. But when it comes to building a company, it is you with a buddy, and here probably vodka in a bar, and you start talking about a business, and then you start working on it, and after six months you realize that maybe the idea was not that great,

maybe nobody has a problem that you thought you wanted to solve. Or maybe you have not figured out how to make money. But now if you use the Internet, and you find people that are passionate about the same things you are passionate about, you have maybe five hundred, maybe just a hundred, or a thousand people that are helping you, that are giving you their honest opinion, their ideas, their connections, you can build a better company. So we set out and did just that. We took the project from Elon Musk, put it on the web, and said everybody who would like to join and work in exchange for stock options in the company, please apply. We had more than 200 applications, got a team together of around a hundred engineers, and started working on the feasibility study, because at that time we did not even know if that was actually doable. So that was three years ago. And many people said, you guys are crazy, this is never going to work. We said, you know, let us wait, let us take a look. The feasibility study was finished at the end of 2014, and today the company has more than 550 people, plus 40 companies and some of the largest companies in the world. So we have Oerlikon Leybold, inventor of the vacuum pump, Reflect, one the leading companies in augmented reality, virtual reality, we work with Amazon, Microsoft, Autodesk. And everybody is determined to get to that goal.

G. Cutmore:

So clearly this is a very different kind of company structure to the one people are normally used to seeing. Historically, I think you find the IP, you develop the IP behind closed doors, you then work out how you are going to exploit it, and you pull people in as you grow the business and put on a salary, and ultimately you get to an end product that you can exploit for a certain amount of time before other competitors come in and try and wrestle away your superior profits. In this case, you have started with a crowdsourcing model, where it seems that the IP is very much open, and is shared...

D. Ahlborn:

No, it is actually not open. I mean, it is a very traditional company, so we are creating IP, but rather than just open source it, everybody gets a small participation in the company. So we have patterns, we have our technologies, we license our technologies, and it allows us to be much, much faster and work on a lot of different elements. I mean, it is not only when you talk about Hyperloop, it is not only moving a capsule inside a tube. That is easy. We did that two years ago. It is about everything else. It is about how do you get to the station? Because we do not want to build something that you use once a year, or maybe 3–4 times a year. We want to build something that changes the way we live. So if it takes you an hour and a half to get to the station and then 36 minutes to get from Los Angeles to San Francisco, you are not going to use it every single day. There are a lot of other things that you have to work on. You have to work on the passenger experience, the connections, the station, everything has to function, and we want to solve the problems that we are having today. If you look at experience when you travel, I do not know if you enjoy going, taking an airplane, but I do not. And I do not know a lot of people that do. So, it is also all things that we can solve. The way we build railways today, is still the same we did a hundred years ago. So the distance – at least in the major part of the world – between the tracks is determined by the Roman carriage. So basically, we are building new infrastructure based on the butts of two horses.

G. Cutmore:

But again, I come back, because I think there is a difference in this business model. And it is a promise that at some point in the future all those participating through the equity will get their payoff. How many people are actually within the business drawing a salary, many years before we have an exploitable technology?

D. Ahlborn:

So the company is scaling up. We are 550. And we have from lawyers to marketing people to doctors, to, obviously, many engineers and psychologists. We now are getting ready and we are having, I think, 4 or 5 actually, that are full-time, so they are managed the others, but we have many companies that are involved – Oerlikon Leybold, for example, there are 30 people that are specialists in vacuum pumps, they are the ones who did the Hadron Collider in Switzerland. We have those people's expertise at our fingertip, and have those teams working full-time for us. It is a different kind of company, that is correct, but it is, I think, the next step, the next iteration if you really think about the model. It is not much different from what is done anywhere else in the startup world. It is just scaled up.

G. Cutmore:

If there is a close comparison that already exists, what would it be? I think of maybe the open source software market place as something that is comparable in the approach. But is there another business that perhaps our audience would already be familiar with, so that that they can just crystallize this model for themselves?

D. Ahlborn:

The way we are doing it has never been done, but yes, I am a big fan of open source, and the problem with open source is that if you want to build a viable business, you cannot, because you are giving a license to everybody else, just like you said earlier – the competitors would have exactly the same technology. So it does not really work, especially with a project like this. The way we are doing it solves these issues, because we still are able to use all advantages of the open source methodology, but still building value for investors in the company and obviously for the team. Open source has been specifically in the

software industry, everything we use today is based somehow on open source. And I think that the term “open innovation” is moving more and more through the companies. You have to think about one thing. And I think everybody who has a company can relate to that. Everybody in our company is fueled by passion. They are not motivated by money. They are motivated by the need and the interest of changing things, being part of something bigger. So that is tremendous. You can work with the best people in the world, you do not need to work with the engineer just because he lives where you have your company, but you can work with the best engineer even if he is in Tokyo. We actually have people all around the world. We are not an American company, we are a worldwide company, we are in Europe, we have people in Russia working on the project, we have people in China, we have people in India, and that allows us to really be completely global. We are also completely open, so people come to us all the time with new ideas, new technologies. If you think about how those projects are done normally, it is done behind a closed door. You hear that someone is building a train, or a metro somewhere. You cannot really participate. Maybe you hear how much it is going to cost. But in our case, we work with the general public, we want to know what they think, we want to know what ideas they have and we ask questions, we question everything. We question things like, do you need a ticket. Because maybe there is a better way of monetizing. If you think about the gaming industry, for example, when I was a kid, and probably in your case too, we had to buy the video games and they were super expensive. Today, they are mostly free, but the video gaming industry actually makes way more money than they used to. So through digitalization and new business models you can come up with better ways. Because if I can find a way where I make more money the more the passenger rides, then a ticket becomes superfluous, then I use the ticket only to regulate demands. If you think about the fact that we spend actually more time in transportation or during our commute

than we are on Facebook or on Google, and the only thing that tries to monetize on it is the radio, then you see the potential that you have there.

So, we did several studies already with MIT, which is part of our team, and the numbers that you can come up with are actually really interesting. Then you think about that the New York metro, for example, loses 2.2 billion dollars a year, which is 87 cents per passenger. They could do better if they would create and use innovation. So these are all the problems that we are trying to solve, that are all going together in order to build the best possible transportation system.

G. Cutmore:

Okay. We would like to have a look at this transportation system, wouldn't we? And just work out how it is going to operate. So I think we have an opportunity here to look at a little bit of presentation on tape to show how it works and what people have been saying about it, so if we could roll the tape.

VIDEO:

- America has always been a nation of doers. We build things. We take risks. And we believe that if you have a good idea and are willing to work hard enough, you can turn that idea into a successful business.
- Billionaire, philanthropist Elon Musk has hinted at a new high-speed transport system that could put planes and trains out of business.
- I have a name for it, name for what is called the Hyperloop.
- So what is Hyperloop? Mr. Musk's plan, move people using a massive vacuum tube combined with a magnetic levitation system.
- And I am like, Jetson's tunnel?
- It is something like that, yeah.
- Here is how he put the idea in May at the All Things D conference.
- It is a cross between a Concorde and a railgun.

- It is called the Hyperloop. It is a system of giant suspended tubes riding within capsules carrying people or freight traveling on cushions of air, it speeds of up to 1,200K per hour, or roughly 1 km every 3 seconds.
- A tube that would be on pillars from Los Angeles to San Francisco, and inside there would be capsule cars that would be rocketed forward at 700 miles an hour, and there would be a fan on the front. Elon Musk basically says that this is the way of the future.
- Hyperloop is something that can never crash, it is immune to weather, it goes 3 or 4 times faster than a train and it would cost you much less than an air ticket.
- It would only cost to build this 6 or 7 billion dollars. Compare that to the 65 billion for the current high-speed rail plans for California. He believes this is a viable, valuable alternative for mass transit between these two destinations.
- Could someone like the Hyperloop actually be the answer to super-fast, environmentally friendly high-speed travel between our busiest cities? So the gauntlet has been thrown down, a design document for a whole new supercool way to travel. The only thing now, will someone pick it up and make the Hyperloop a reality.
- There are some companies that are forming to try to make the Hyperloop happen. And I encourage them, and I think that is great.
- Tesla founder Elon Musk proposed this new technology called Hyperloop and it is being developed right now in Playa Vista here in this centre behind me.
- The only resistance would be the air in front of the capsule, which we move to the back by using a compressor.
- Company Hyperloop has teamed up with the students to create this tube technology that is designed to connect cities up to 400 miles apart. Dirk Ahlborn says it is safer and more efficient than the railroad.
- The system is completely computerized. So, you optimize the system and then you actually have the humans to monitor it. In railroad, most accidents were all human factors. Plus, a lot of the derailments actually happen because something

is on the track. We are in a closed system completely managed by a computer system. There is no human factor that can actually create those issues.

- We actually plan on seeing the first Hyperloop very, very soon starting.

- Can you imagine and walk us through what it might be like to travel at the speed of sound?

- It is not going to be much different than sitting in an airplane. Obviously, for us it is very important to make it as good of an experience as possible.

- This is an independent organization that has formed. We have 170 engineers, scientists and really great professionals with amazing backgrounds.

- The race is on. Elon Musk's vision for a high-speed passenger pods known as the Hyperloop is one step closer to becoming reality this morning. One of the known companies competing to capitalize on Musk's proposal announced today it has struck a deal with landowners in Central California to build the first full-scale Hyperloop along a 5-mile stretch along I-5 with construction set to begin in 2016.

- Let's bring in Dirk Ahlborn who is the man who runs the Hyperloop Transportation Technologies team which is announcing this deal with Quay Valley, CA. Dirk, tell me about this deal and really, when do you expect this Hyperloop, this 5-mile stretch to be finished.

- Quay Valley is supposed to be breaking ground beginning of 2016, that is when we will be starting working on our development, so we will be starting around at the same time. At this moment, we expect to be done by 2018.

- Hyperloop now appears one step closer to reality. Starting next year that theory will turn into a ground breaking in Quay Valley, King's county, off of I-5. A developer there has just committed a big chunk of his private land toward the project. It is a 5-mile loop that would take visitors through a planned entertainment district.

- There is going to be a test track, Elon Musk has announced that he is going to build a small-scale test track. It is a necessary step for us to be building a full-

scale version, and Quay Valley is a sustainable model town of the 21st century, so it is a perfect fit. They are expecting over 10 million visitors per year, so we will actually be able to generate revenues very, very fast.

- The company plans to go public later this year.
- We want to do a public offering, we want to give our communities that are supporting us a possibility to own parts of the company.
- We want to make sure that the people that have been helping, building the company and this technology are able to participate in the investment, in the fundraising at the outset of the company.
- With their contributions to Hyperloop, these students from around the world now have stock options in the company. But they say they are not in it for the money.
- As a student I start to feel like I am a part of some great career that might change the world.
- Will the Hyperloop kill the railroad?
- The Hyperloop is going to do to the US what the railroads did in the 1800's. So it will change the way we live. It is possible today, it is based on existing technologies and it is the right time, the right moment to finally get something doing like this.
- Is it visionary? In 30 years' time, will you and I be sitting in our rocking chairs, going "Well, we talked about it then and it did it."
- So you think this is possible, this is not just...
- Yes, absolutely, absolutely.
- For all those who said this is just a neat little thing to draw on a cocktail napkin, these guys are saying, it will become reality.

G. Cutmore:

So, there is a good explanation of how Hyperloop is going to work and what people have been saying about it. Since that video was made, how have

timeframes changed, if at all? When could we expect to see a fully working version that gives everybody an understanding of how then to turn it into something that can be commercially exploited?

D. Ahlborn:

There were a couple of new developments. We are still on track in Quay Valley, so we filed the building permits beginning of the year, we did the mapping and the surveying, we are doing the environmentals. It depends a little bit on the county, you know. The moment you touch politics, government, you are waiting. But we expect to be breaking ground this year. From there, it is 36 months until we can open up basically for the public. In the meantime, we are also busy and we signed an agreement with Slovakia, so we are looking into a route, first, a local route in Bratislava with the future vision of connecting Bratislava and Vienna. We are in discussions with 14 other countries, so you know, at this point it is really just all about moving forward, building, showing the technology, optimizing the system and then we will see. I think that we will see a lot of tracks coming up very, very soon.

G. Cutmore:

It is interesting the countries that are giving you the firmest commitments at this point, not necessarily the ones you would imagine would be pushing ahead with this kind of technology very rapidly. Can I ask you, a lot of people here will be thinking about the Russian context, and whether it is an appropriate transport system for Russia at this time? What is your view on that and what is holding back do you think some countries from embracing it?

D. Ahlborn:

I think in general Russia is a great example, because you have a very large country, and obviously being able to connect those cities in a fairly short time

completely changes how you live and how you work and how people are connected. So think about all those areas that are very remote that can be connected in short timeframes. There is in addition Russia is very interestingly positioned towards China – talking about the Silk Road, for example. We had discussions... Slovakia is actually part of the Silk Road project, so we have been talking with them and others. Holding back... We met with the State Secretary of Transportation Foxx in the US, they are very willing to move things forward in general. It is just complicated because the laws are often very complicated for these very large infrastructure projects, so for sure, countries that have decision powers, that is different, where there is existing right of ways that we can use, things are a little bit easier. You definitely need a country for the regulations to push. There has been a lot of discussion in Russia, so since we started now, there have been a couple of other companies trying to do the same thing. There is one in particular that is confused with us a lot of the times, which announced that they are working, they are doing something in Russia. They are still doing the propulsion tests, and they are only concentrating on freights, so I assume that there is some interest in the freight area. From our point of view, I mean the main part is really changing people's lives, changing the way you live, the way you work. The Hyperloop has the potential to change the world the way the railroads did, because distances just become different. You can live 150 km outside of Moscow, for example, and be inside the city centre within 10 minutes. So if you think about Los Angeles, for example, you need to spend at least a million dollars to buy a house where you do not risk to get shot in your front yard. So those things alone, for the real estate values, that you would create, you could build the Hyperloop with that. So money in this project is not an issue, there are plenty of people out there, plenty of investors in Asia, in America, that are willing to invest into these systems. It is regulations and right of ways that you need to solve.

G. Cutmore:

And in terms of the funding, would you see it as a private–public partnership that finally gets the project completed, or would you follow the Elon Musk approach and try and make this totally privately funded?

D. Ahlborn:

We are not the transportation company. Our customers are normally the transportation companies. And these kinds of projects are normally done in a private–public partnership, because the government wants to control it. If you want to build something in the Emirates or in Saudi Arabia, there is no way they will let you do it privately. They want to control it. But money again, the moment you have a business model, and the moment it is just about, “hey, let’s spend this amount of money and it is going to take you this many years to get it back”, it is not an issue. What I think we should do better is, rather than spending billions, because it is literally billions of dollars (in California it is 62 billion dollars for the high-speed rail) rather than going out and just spending those billions of dollars for old infrastructure, maybe we should take a billion dollars and just invest in something and see if we can do a better job.

G. Cutmore:

And what do you think the cost per kilometre will ultimately be?

D. Ahlborn:

So in America, in California right now we are at roughly 15 million dollars per kilometre. That is on the high end.

G. Cutmore:

And do you expect those costs to rise significantly as you get closer to the project?

D. Ahlborn:

No, no, this cost is basically already completely specked out with all our suppliers, so we know how much the foundations cost us, we know how much the pylons cost us, we know how much the tubes cost us, the propulsion systems, and the capsules. Everything is specked out at this point, because we are getting ready to build, so we have all of our suppliers aligned in order to get ready and start construction. But I do believe that, for example, in Russia, you will be able to make it cheaper; in China, you will probably be able to make it cheaper still, and China in general is less expensive, labour costs are less expensive. Obviously, in Russia there is a huge expertise in building pipelines, right? This is basically what this is. You are building a pipeline.

G. Cutmore:

You mentioned the competition. You brought it up instead of me, so I feel comfortable asking you – what is the major difference between your business and, say, Hyperloop One, that claims they have something that won a competition and represents closer to the original Elon Musk idea?

D. Ahlborn:

Honestly, I do not really know much about them. We are really focusing on what we are doing. From the parts that I know, they just did the propulsion tests, so it is still a long way to go, it is more about moving a capsule inside a tube, and they are saying that they are working on freight. I am sure every time we are in the news, they say that they are working on passengers as well. But there is a huge difference between building something for freight and building something for people. You have to make sure that the system is the safest possible system out there. Safety has to be in the engineering from the beginning. You cannot just build something for freight and then say “okay, now we adapt it to passengers”. You can do it the other way around, which is kind of how we are doing it. So you

start off with the more difficult part. We have developed new materials, for example, we have developed smart composite material which we call vibranium, which senses structural integrity. We have a double wall system, where you are completely safe even if something happens to the outer wall or the inner wall. We have a passive magnetic levitation system, which was developed by one of the national security labs in America; and being passive means that it does not require any power to levitate. Levitation occurs through motion, which also means that in case of an emergency, if for example electricity would go away, it just does not touch the ground, it only goes back once the capsule is under a certain speed again. All these elements are very important when you talk about safety – thinking about how to get people out, emergency exits, all those seconds to depressurize the system. You know, the system in general is ten times safer than an airplane, but you have to think about all those things, and you have to make sure that they are there.

G. Cutmore:

Well, I would like to open up to questions. If you have some questions, please raise your hand. We will get a microphone to you. I see a hand here and a hand over here, but we will start with the gentleman down here, and I believe we do have translation available, so feel free to ask your question in Russian. Can we switch on that microphone? Tell us who you are.

From the audience:

My name is Andrei Kostyukov, I am the director of the scientific and production centre “Dynamics”, a Russian based R&D company. I have several questions. How many engineers do you have in the 550 staff in your company?

D. Ahlborn:

So it is more than 550, because we have several companies, we have roughly 40 companies that are part of our team as well. I do not know the exact number of engineers. We have 30 people in the vacuum technology, we have CFD analysis, which is probably what is mostly interesting for you, we have roughly twelve. But we also have several universities working on the CFD, for example, so I would say that the ratio, when we look at the overall number, is probably somewhere around 70% engineers.

From the audience:

Okay, thank you. And one more question. You mentioned that CAPEX is about 50 million dollars per kilometer... Fifteen. Okay. How much are operation expenses, for example, energy consumption of this project? This, I think, is the main question.

D. Ahlborn:

Yes. That is actually one of the main advantages, because we are producing our own energy, we have solar panels on top of the system in California with the latest technologies, we are capable only with solar to cover a 100% of our energy needs. In addition, we have wind and kinetic energy through regenerative braking. So we are actually energy positive, at least in California at this moment. We are looking at other alternative energies like geothermal in Slovakia, wind and geothermal is probably a little bit better there, but those calculations have not been finished yet.

From the audience:

Thank you.

G. Cutmore:

OK, lovely, thank you.

There was a hand that went up here, that gentleman we will take you first. Let's get the microphone over to you. And then I will take one over here, the hand I saw first, and then there was a lady down here.

From the audience:

Hello. My name is Dmitri Zaluzhny, I am the regional investment expert and my question is not about money, my question is about time. So when we are talking about the implementation of the project, how much time does it take to build, for example, 10 km or 100 km? Because you understand that it can take too much time and everybody will forget about the project, so how much time it will take compared with the standard system?

D. Ahlborn:

So one of the advantages of this system is that it is pretty much standardized. So everything can be manufactured in a way that it goes fairly fast. It depends a little bit how you invest into the project. You need to buy more forms, for example. We are working with one of the largest steel manufacturers and steel tubes are only one of the solutions, there is composite and even concrete. They are giving us 50 km per year as what is possible in terms of supply right now. Which I think probably is the determining factor.

G. Cutmore:

The first hand that I saw go up here, can we get the microphone, please, to that gentleman in the middle of the row?

From the audience:

Alexey Romanenko, management consulting KPMG Russia. So my question is not about money and not about time, my question is rather about social and emotional experience. People choose certain types of transportation because it

gives them experiences. They take the seat near the window because it is an emotional experience. So what will be the emotional experience by moving 1,200 km per hour in a tube?

D. Ahlborn:

So I would say it is very similar to an airplane. In terms of the feeling, we are actually doing a lot in terms of the passenger experience. I am personally not happy with none of the modes of transportation that we have right now, maybe besides my personal car. I think we can do better overall. We have several psychologists on the team, we are developing actively technology to make passenger experience better. We have a technology that is based on graphene that cleans the air from bacteria, viruses and smells. Because that is one of the biggest issues people have when they take an airplane, or on the train – they do not want to touch anything, or you have someone eating something behind you, or someone coughing next to you. So, all those issues are very important in terms of the issue of being inside a tube. We are developing a technology that we call augmented windows, which is the screen technology where we use head tracking and we move the image based on where the passenger is moving, so that we actually can simulate a window. And now you can use virtual reality to basically have you go through a different experience. So it has kind of a double use, because on the one hand it is better for the psychology end, on the other hand, it is actually monetization possibility for the transportation companies. So we can create experience content basically, so you could go through Terminator land or Jurassic walls for example, and maybe you could find it very interesting and exciting. I can think of a lot of other uses for these kinds of technologies. But it is very important, we are also working on different smells, noise, all these things are very important to make the passenger feel the best way possible. Things that really have not been done so far, not because they are not possible, just because nobody really cares. And we are trying to really get to the best

possible passenger experience. Because again, the more the passenger rides, the more money we make.

G. Cutmore:

The lady down here in the front, if we could pass the microphone along. I will try and get as many people in as I can in the time that we have available.

From the audience:

Good evening, my name is Irina Shapovalova, I am the Associated Professor from the Logistics and Policy department of St. Petersburg State University of Economics. As a person who is dealing with logistics aspects, when I was watching this video, I thought about a Transsiberian Hyperloop system, something like that we could apply in Russia, but I have got a question. Have you thought, do you think about moving freight by this transport, is it possible to move big size freight using Hyperloop? Thank you.

D. Ahlborn:

Yes. we can move containers. It would be a single container per pod, which has an advantage because you do not have to load up the whole truck, it is more like, compared to the Internet, it is packages, right? Freight is an important part of the business model. We are not concentrating as much on freight because freight is easier. Freight does not really complain, it does not normally die, so for us it is much more important to get it right with the passengers. Freight is something that we do on the off-peak hours, we can have a capsule every 40 seconds, so in terms of capacity it looks very good. But yes, as I said earlier, we are looking at the Silk Road project, for example, as one. And so we are collaborating with a couple of freight companies, some of the largest ones, in order to really understand how the system can be used in the best way possible. On demand, people want goods faster, if you can think about the Silk Road as an example,

and now you can get goods from China to Europe within hours, rather than weeks, it changes for sure the way people consume.

G. Cutmore:

The gentleman down here in the front.

From the audience:

My name is Terenty Mesheryakov, I am the CEO of the Transport Directorate FIFA World Cup Russia. First of all, thank you very much for your very interesting presentation. You mentioned that Hyperloop is 10 times safer than the plane. And I think it is from the technical point of view, and I think one of the main challenges for the global world is terrorism. How is it, when we see a modern airport, we see a lot of security control, walls, bars, all security systems, to make a plane have a safer flight on the altitude of 10 km. And how is Hyperloop safe from this point of view, how is it safe against external damage? Thank you.

D. Ahlborn:

It is a question that I actually get quite often. Unfortunately, when people want to do bad things, they will do bad things. So you cannot protect yourself from bad people. When you mention the airports, I do not know if you are aware, but most of the measures that are done in airports, those things where you stand and put your hands up, they do not work. If you go on the Internet and you go on Youtube and you google a little bit, you see exactly how people with guns in their pockets just go past them. It is more of a psychology element most of the time, to make you feel safe. And in our case, the damage is, I would say, if you would do a terrorist attack in the Russian subway, in the metro in Moscow, you would probably kill way more people. Remember, the pod is always only 28 people. However, for us security and safety in general is very important, so we are working with newer technologies, they are more passive. From facial and voice

surveillance to systems that scan you while you are going by, in order to detect identities and important parts, so you create an account and basically we use fingerprints to really know who you are. The system in itself, the threat might be from the outside, so we are engineering the pylons that are bomb safe, so nothing happens if someone goes against with a truck or fires an RPG against it, these kinds of things can be done. But there is a limit. If someone wants to do something, they will. One of the advantages for sure and the difference between a rail or a metro and what you see in airports is that you cannot fly them into building, which is the issue that we have with airplanes. They can actually be used as weapons, if you want. But we can only try to make it as secure as possible. At the end, you cannot cover 100%.

G. Cutmore:

Okay. I saw a hand down here, gentleman down there in the front.

From the audience:

Good afternoon, I am Alexander, entrepreneur, it is a futuristic approach, there are a great many people who are connected to the Internet, and you have said that your company is distributed globally. You have a certain connectivity and do not you think that mankind, having new technologies of virtual reality, then in 10 years or 20 years there will be no need to move around the globe. To meet you, I will need you to come to St. Petersburg, we will just load a picture and we will be communicating and talking, not in close proximity with one another. Do not you think your project in particular is in contradiction with the global trends?

D. Ahlborn:

I think that virtual reality has a lot of great applications and there is a project from Microsoft, where they are trying to do something very similar to that, and I am sure that to some extent collaboration will get easier with people around the

globe because you can be present with them. But nevertheless, I still want to experience St. Petersburg, so I will still come to St. Petersburg. I am hopefully going to have more time because of exactly those technologies. And I still believe that people will be traveling in the future, but definitely those technologies will make our lives easier and give us more time to do things we love. But I am not worried for the business, definitely.

G. Cutmore:

I think there are some experiences that cannot be replaced by virtual reality, right? But maybe we would better not get into that here.

Yes, sir?

From the audience:

Hello. My name is Mikhail Gordin, I work for the National Research Centre Zhukovsky Institute, which is aeronautics and aviation research centre in Russia. My question is more practical, what about your certification strategy? Did you choose the organization, which certifies this technology in the US, is it the FAA or any other organization, because things that move 1,200 km per hour really look like a plane in terms of safety and everything. And then, if you know what to do in the US, what is your approach going to be internationally? International certification is also an issue. And usually in aviation certification is a very significant part of the development cycle. So what is your plan about that? Thank you.

D. Ahlborn:

Curiously, we actually started that process mostly in Europe. So we are working right now with TÜV in Slovakia and Germany. We also started the discussions in America. And it looks like most of the parts are actually falling under rail, with some elements, specifically because of the low pressure environment that needs

to be looked at specially. But the question is a good question. We are moving forward right now and that is exactly where the help and the importance comes in to work together with the government. Because you know, you do not really know where it fits in and where it should be, and it does not really have all those complexities that an airplane has because it is basically on a track inside a controlled environment, it can only go in one direction, but you are in a low pressure environment, so you have all the safety issues. So yes, we are in the process actually right now. But at the moment we are moving forward faster in Europe than we do anywhere else.

G. Cutmore:

The gentleman in the middle there, at the back. We will come back to you, sir. But I know that chap has been waiting for a while.

From the audience:

You are doing this very fairly, Geoff.

G. Cutmore:

Well, I am trying my best.

From the audience:

I have two quick questions, one is very, very quick and straightforward – is there an upper limit to the distance? Right now you say it is 400 miles, is there a physical constraint that it could never be more than 800 miles, for instance, or is it something that one generation, two generations, three generations from now we could be going around the world in these tubes? First question. Second question, this is very disruptive technology, it has the potential to render rail and air travel obsolete, not instantly, because it takes time to build this infrastructure, but over the course of 30–40–50 years, can you imagine if all of the rail track in

the USA and the world in the space of 60 years becomes obsolete. Is there some way that you as a company could utilize that to further enhance your profitability or to somehow add a social or corporate social responsibility aspect to your profit model? Two distinct questions.

D. Ahlborn:

Can you just repeat the first one?

From the audience:

The first one, is there an upper limit to how far you can go?

D. Ahlborn:

Two things. In terms of the upper limit. One is cost. So at a certain point when you say, I want to go from Los Angeles to New York, it might make more sense to go with the new airplane technology that is being developed right now. Just too cost extensive to do that in one. Once there is a network, so once you go from LA to Las Vegas, from Las Vegas you go to Memphis, for example, and you move your way up. It is completely possible. The second one is energy. The way we are working to make it the most feasible, a lot of the energy that is being used to propel the vessel is stored inside the pot, so initially you have track-side pushers. So, battery technology gets you only so far, because you need to have a certain amount of batteries on board. But that is a development that luckily looks every year better and better and better. So we will be able to always go further. Those are the two elements that really make it viable in my opinion right now up to 1000 miles. Everything more at this moment is economically not feasible, it is just not something we should be looking at. Most of the tracks we are looking at something like 600 km, 400 miles, and less. And also a lot of local systems, i.e. inner city transports where they are losing a lot of money right now.

So, speed is only one of the advantages of the system, the other part is really that it does have a business model.

So your second question, where you can take the old aircraft... One of the big advantages of our system is that we are on pylons. So we can go along existing right of way. We are able to use, to a big extent, existing right of way, as long as they go fairly straight. We are talking about highways, we are talking about existing rail lines. If it is a high speed rail line, normally they are fairly straight, so those are already well tracked. It is not that we cannot do more curves but we just have to slow down, so if you really want to get up to speed, you need to be as straight as possible. But I personally do not believe that trains are going to disappear. We are actually working with a lot of transportation companies to use some of the technologies that we are developing inside existing trains to come up with better business models and help making them a little bit more profitable. And there are a lot of people that are enjoying riding a train. For a lot of people it is a choice.

G. Cutmore:

The gentleman down here. And I think we will take this the last.

From the audience:

Good evening, my name is Maxim, I am an entrepreneur and I have a startup related to photovoltaics. Two questions, one is about the team and the governance. You said there are more than 500 people in your team, how do you interact with them, how do you provide incentives for them, how do you coordinate their work, how do you understand who fits in and who does not? I realize, they are primarily volunteers, and that is the first question. The second one is that the projects associated with Elon Musk are very impressive, and many ideas seem to be impossible to implement. However, people take them and make them happen, implement them. How do you dare to do that, do you

think it is possible to repeat something as grandiose in other countries, to duplicate it other countries like in Russia and what is needed for that?

D. Ahlborn:

First of all, we have a team and we have the community. The community right now is over 30,000 people, and these 30,000 people are participating, contributing, basically supporting with their ideas and contacts, and so that is very helpful. Just having an open approach. When we go to the team, the team is actually not much different from probably how you run your company. It has a hierarchy, so we have an HR department, we have a legal department, and normally they are working in teams and sub-teams from 4 to 7 people. We found out that as soon as we have more than 7 people, there is someone in there that does not perform. Somehow, we as humans are not capable of making more connections than 8. So it is kind of like the magic number, at least at the beginning we saw that as a big problem – let's throw 20 people on it, that does not solve anything. So these 4 to 7 people, they know what they have to do, there is another team that makes sure that they are on track, they have their due diligence, they have their tasks, their due dates, we are trying to make sure that they hit those due dates. It is really like in any other company, it is not much different. But yes, the only thing that really changes is that they feel more entitled to know everything. You have to explain to them that “well, if you are a programmer you do not really need to know everything we are doing in propulsion and levitation”. So there is IP issues just like in other companies, so we unfortunately cannot share everything openly with everybody. So that sometimes creates issues. Motivation is always an issue, I think. It is an issue when you have people that you pay, it is an issue when you have people that are fueled by passion. I think it is important to always make progress, move forward, step by step and show that you are doing things. I do not want to say that the model we are using is perfect. We are still learning. A lot of the things that we

did, did not work. We changed. We found a way to make it work. A lot of the things are still not working perfectly. We can do better. But it is the easiest company I have ever built. You can imagine if you are CEO of a company, you know that no matter what happens tomorrow, your people will show up because they are fueled by the same passion you have. That is a big thing. And they are pushing. As an entrepreneur, you have ups and downs. One day you feel like you are on the top of mountain and you are the king, and the next day you feel like you are never going to make it. I have a huge amount of people behind me just pushing me forward. So it is not me. I am not really doing anything, it is really this team. And it is amazing. And obviously a lot of the companies are bringing great expertise in their field. I can only encourage everybody to try out, to build something up. And you do not need to have 700 or 600 people, it is enough if you have 10 that work that way. In terms of daring to do things, I do not know. I think a lot of times it is just trying things out, I mean when we started we did not know if this was possible. There were so many people that said “you cannot do this, this is not doable, the pods heats up, you cannot get the temperature away”, whatever, I have heard anything, “the cost is too high”. So what we did, we just said “okay, we do not know, let’s take a look”. One of the things that I find specifically, I am European, I am actually German, and we have the same problem that we have in a lot of countries, and I think Russia is the same, that it is not okay to fail. You are supposed to succeed, while it is necessary to fail. Like I said earlier, our model is not perfect, we are learning, which means that we have failed at some points. And with failure being okay, I do not mean that you should just give up. It is not okay to give up, in my opinion. That is something maybe that happens too much in America, but it is okay if something does not work out but you tried really hard. Any company is always on the cutting edge of destruction. Today you can be the best company in the world, Uber, and tomorrow maybe you do not exist anymore. That is just how it is. At the end all you have to do is to go for it and do your best. In my opinion if you try to solve the

bigger problems, if you take a bigger vision and you have a bigger goal, which is something, again, I think in Europe and I assume in Russia, I am not sure, but when I travel I see those things a lot when I talk to startup companies, their vision is not big enough. For them it is about incremental. I want to sell some solar panels. Why not really go higher and pick the highest goal that you can try to achieve because then other people are going to follow you. They are going to say “wow, that is amazing, I want to be part of this”, and they are going to help you. And the one thing I learned which is amazing, is actually just ask. So when I talk to people and I tell them what I do, and they are like, “wow, that is so cool”, the next thing you have to do, is like, well, do you want to join? Do you want to help me? And normally they say, “yes, of course, how can I help you?” We have done the same thing with sponsors, we got hundreds of thousands of dollars from Microsoft, from Amazon in cloud services. We got software products from from Ansys, from Autodesk as our sponsors, because they see the vision behind, they want to be part of this project. And all you have to do is ask. The universities, the students, they are happy to participate in a real-world project that they can follow passionately rather than working on something theoretical. So, I think yes, one of the things that I enjoy about what we are doing and I hope we are trying to do is also inspire people to try to solve bigger problems and go after not the easy thing or not trying to build just the next WhatsApp and sell to Facebook or to Google. But let’s solve the issues. When I went to a pre-school the other day and I was working with the kids, it was a career day and it was in a low-income neighborhood in Los Angeles and I was asking them, what do you want to do, and I asked them, what is the problem you would like to solve. The problems that they want to solve are really big. One of the things they thought of is world hunger. There is a lot of ways you could solve world hunger as an entrepreneur or at least try. And I could put together a team in that elementary school fairly easy because in every class there were at least 3–4 people that wanted to solve their problem. And it is the same in society. There are people

who are passionate about the same things you are passionate about. There are plenty of them, you just have to find them.

G. Cutmore:

Dirk, it has been a real pleasure listening to you and thank you for taking so many of our questions here and if we could just thank Dirk in the usual fashion for giving us the benefit of his vision for Hyperloop. Thank you.