Collegial atmosphere: Dr. Christoph Roggendorf (left) and Dr. Matthias Maurer meet at the Columbus module at ESA's European Astronaut Center in Cologne.

In the same orbit: How aerospace and industry learn from each other

22/10/2025 How can automotive development service providers and aerospace benefit from each other? In this interview, ESA astronaut Dr. Matthias Maurer and Dr. Christoph Roggendorf from Porsche Engineering talk about material research, autonomous systems, and virtual test methods.

Mr. Maurer, you are a passionate scientist and spent six months conducting research on the International Space Station ISS in 2021/2022 with the Cosmic Kiss mission—including extra-vehicular activity. Now you are in charge of setting up the LUNA Analog Facility in Cologne, the ESA and DLR simulation facility for future lunar missions. Are you satisfied with the pace of this lunar approach?

Dr. Matthias Maurer: I am very satisfied with our LUNA moon training facility—I would even go as far as to say that it is the most advanced facility in the world. Even NASA recently visited us in Cologne to conduct measurements here. Its employees tested a new camera here which will be used on the moon—I was then allowed to test it in the extreme conditions simulated here. We're very proud of that. We will also soon be testing a new lunar station here. You can imagine a high-tech container in which we will spend weeks living in realistic conditions. A tunnel will then connect this container to the LUNA training facility. This also means that we will not leave these connected areas during the simulated operation—and therefore won't see any sunlight either. On the surface of the moon there is high abrasive volcanic dust to deal with. Rock on the moon hardly moves, since there is no water and no wind either due to the lack of an atmosphere. This is why the shape of the sand grains is sharp edged and also the sand is very sticky, much like flour. Added to this are craters whose depth is difficult to estimate and icy temperatures as low as 150 degrees below zero. In the shady areas of the moon, in the deep craters, into which sunlight never penetrates, temperatures can plummet as low as 250 degrees below zero. Another challenge is the low-lying sun, which casts tricky shadows. This is what awaits us in the polar region of the moon—and this is where we intend to go.

That all sounds very concrete - what are the remaining challenges?

Dr. Matthias Maurer: What we don't have at the moment is our own rocket and capsule. The challenge this involves is that both the rocket and the capsule must be certified for transporting people. The special consideration here is that the capsule must return at some point, and must not burn up when it re-enters the Earth's atmosphere. This is due to the high speed and the frictional heat that is generated upon re-entry. In the past, we relied heavily on international engineering and partnerships here. However, it is time for Europe to step up its resilience in this respect—this certainly applies to several sectors, but aerospace is a key one.

Mr. Roggendorf, you come from the world of mobility systems, and yet you have long been working in all domains: from the road to space. How is it possible, as a development service provider, to succeed in dealing with such a broad spectrum—not least in visionary projects with many unknowns?

Dr. Christoph Roggendorf: This broad spectrum is exactly what drives us and inspires us as engineers. In our interdisciplinary teams, for example, a large proportion of developers have a background in aeronautic and aerospace technology. These skills help us with a wide range of technical challenges in a wide range of industries. We are currently developing a complete energy system for satellite applications. The requirements in low-earth orbit are very similar to those in the automotive sector, for example with regard to temperature profiles or vibrations during a rocket launch.

Mr. Maurer, ESA is an aerospace agency and has a very different setup to commercial companies. What ways of thinking and working are crucial to allow people to be able to actually live and work on the moon one day?

Dr. Matthias Maurer:ESA operates with taxpayers' money, which means that we use this money in a very responsible manner. It also means, however, that we face quite a lot of bureaucracy and have to deal with delays that private companies in industry do not have to the same extent. We often say: Let's do a study— and then a second and a third. The aim is to meet legal requirements and to proceed very correctly. The main task of ESA is to specify the direction, to define programs, and to outsource them to industry. If the industry itself could define goals and address them at its own risk and with its own capital, supported by ESA as a reliable anchor customer, this would certainly introduce more speed and agility. And at this point, we also need more players.

Mr. Roggendorf, how do you see the future in this regard?

Dr. Christoph Roggendorf: We have always had the drive to venture beyond the automotive industry and into other industries. It is exciting for us to combine knowledge from different industries and to make a contribution with our engineering services. Process-efficient—from proof of concept and testing of physical limits at an early stage, through to the fastest possible approach to a solution that is ready for series production.

Of course, research and progress cannot be achieved without setbacks. As a development service provider, how do you deal with failure? How do you succeed in boldly developing new technologies and at the same time validating processes for customers?

Dr. Christoph Roggendorf: This depends entirely on the stage of development and customer expectations. There's a Ferry Porsche quote that fits perfectly here: "We are not afraid of setbacks. On the contrary, we expect them. If you don't fail from time to time, then you didn't really challenge yourself." This is the motto that we apply to our work every day. As an engineer, I have to and want to test the limits of what is technically feasible, especially in pre-development phases. If everything always goes smoothly, then I have learned too little. We have to promote an error culture that allows mistakes to be made in these phases. Of course, this is different in the series phase. At that point, we have to have an absolutely functionally reliable, error-free, and high-quality product.

Mr. Maurer, in manned space flight in particular, the reliability of a development is a matter of life and death. How do you strike a balance between „better safe than sorry" and the courage to take risks?

Dr. Matthias Maurer: Up to now, aerospace agencies have always carried out an extremely large number of tests in order to rule out as many errors as possible before launching a rocket—this is, of course, very time consuming. And you can learn a lot from it, in particular when something goes wrong. In the meantime, a new error culture has taken root in aerospace due to the influence of industry: "Fail early, fail often." This happens to a certain extent in large-scale rocket projects—a rocket explodes and employees cheer because they weren't expecting a total success in the first place. It's hard for me to imagine that happening at ESA, but it's a direction we need to take. Of course, only as long as there are no people sitting in these rockets and no one is harmed on the ground. As soon as we start talking about manned space flight, we must have an absolute zero-error policy—and a reliable fallback system. If a rocket has a problem, the astronauts in the capsule are ejected and come back down to earth with the parachute. And this fallback system has actually already been needed, and resulted in the astronauts landing safely.

To what extent can aerospace benefit from industrial and commercial achievements in terms of cost-effective manufacturing and profitable development timeframes? And what can space research

specifically do for companies?

Dr. Matthias Maurer: I'm very keen on the idea of "spin-in". That is to say, to ensure that we incorporate industrial capabilities and innovations into aerospace projects. The automotive industry is so innovative and so fast in development that an incredible amount of technology is either already in use, almost ready for series production, or at least in the drawer. I dream of opening this drawer and tipping its contents into the aerospace sector. The prerequisite for this is establishing a dialog between the two worlds. After all, something has shifted in terms of innovation drivers. In the past, the entire IT system had to be developed for the Apollo mission. That was a driver of innovation, if you look at the patents that emerged from that. However, in today's aerospace, we have highly established processes and make use of a lot of heritage. Using new technologies means overcoming new hurdles—and the technologies must be certified. As a result, we use very old systems and even older computers on the ISS. I hope that we will increasingly introduce new technology—and dialog, as we are engaging in here today, is essential for this.

Mr. Roggendorf, to what extent can industry and you, as a development service provider, benefit from aerospace programs?

Dr. Christoph Roggendorf: The topic of material research is always very exciting for us, and also one of Mr. Maurer's pet passions. Historically, many high-end materials from which industry has benefited have come from aerospace applications. And that's where these two worlds are growing together. New business areas are emerging—we are now also involved in the satellite sector, for example. Traditionally, virtually every satellite has been a one-off. The objective now is to see how such systems can be standardized and constructed in a modular way. This means our experience allows us to provide assistance in the industrialization of products and thereby enable our customers to scale up in the new business areas.

Dr. Matthias Maurer: Autonomous systems are also a major issue that exhibits an overlap. On Earth, the focus is on autonomous driving with artificial intelligence. In space, we are now also reaching a level of traffic density in which individual people will soon no longer be able to control all of the satellites. There are more than 12,000 satellites in orbit, some of which are no longer active and therefore no longer controllable. So there are lots of wrong-way drivers up there in space, which we either have to sidestep or capture. These satellites have been controlled by people on Earth, but this will no longer be possible given the sheer number of satellites. This control must be replaced by artificial intelligence - the satellites must use it to operate autonomously. The terrestrial and cosmic challenges and questions are pointing in the same direction. Aside from the fact that we don't need a reverse gear in space. (laughs)

Dr. Christoph Roggendorf: When we think about autonomously controlled satellites, the question of precision also arises. And we have a lot of experience with that. In the automotive industry, we're talking about centimeters—for satellites, we are talking about many kilometers. However, the intervention mechanisms are comparable. And we can also make a valuable contribution to fleet management-given increasing numbers—with our methods and tools in the areas of control and automation, and even artificial intelligence.

Staying on this topic: Mr. Roggendorf, how can this knowledge—for example, with regard to development processes, virtual test methods or high integration—be applied to aerospace projects?

Dr. Christoph Roggendorf: I think these are exactly the methods that need to be used in the aerospace sector. Virtual testing methods are a great example. We are working on digital twins of entire systems. Let's take a vehicle battery as an example. Through a digital twin and live data transmission, we come to know and understand the system in great detail during development. I can get the most out of it and extend the service life of the battery. Virtual methods and processes like these are, of course, even more important in space. After all, I can't repair things or refuel as easily. Every gram of fuel and everything I have to bring up there costs an immense amount of money.

Dr. Matthias Maurer: In fact, we also use VR technology with twin models here at the LUNA training facility, because we cannot reproduce every device as a physical model. Instead, we wear VR glasses in our spacesuit and display different devices, measuring instruments or another space station in order to interact with them.

Dr. Christoph Roggendorf: If you take this idea in regard to the methods a step further, we invest a great deal of effort in achieving end-to-end solutions - that is, from the product definition to automation of requirements and the generation of test cases with the support of AI, to efficient evaluation of live analysis data. In the case of highly individualized products in particular, where these development phases take an extremely long time, we can become significantly faster with an end-to-end toolchain.

Another common feature of your two fields of activity is the global orientation. How important is the international network?

Dr. Matthias Maurer: Space flights is such a vast undertaking, and no single country in Europe can manage it alone. As already mentioned, we in Europe as a whole are not yet in a position to fly our own astronauts. We could do that in terms of content, but the financing is unresolved. We have incredible strengths thanks to the huge wealth of experience of different European cultures and different fields of engineering expertise. We can generate potential from this—and we can significantly expand this potential by opening the doors and working together with experts who come from outside the aerospace industry. This will enable us to put Europe in the pole position.

Dr. Christoph Roggendorf: For us at Porsche Engineering, internationalization is very important and a key factor for our success. In Europe, we operate a number of different locations: apart from Germany mostly in Czechia and Romania. We also have a large test facility and an engineering hub in Italy. Our asset is the engineers, the brains of the operation. In order to attract the best talent, the most motivated and highly trained engineers, cooperation with universities in various regions of the world is extremely important. We also have development locations in the US and China. Above all, because they have very different requirements for vehicles than in Europe. Thanks to our local presence, we understand much better what the specific market needs. In terms of connectivity alone, we are dealing with completely different ecosystems, entire app worlds on smartphones, particularly in China. Vehicles are simply used differently there. The right ideas won't occur to you while you're sitting in an office in Germany. In addition to the purely technical side, intercultural cooperation is extremely instructive and fruitful in regard to other ways of working.

Finally, a personal question for both of you: What drives you?

Dr. Christoph Roggendorf: It was clear to me at an early stage: I will become an engineer because of my passion for technology. I love trying things out, developing things, refining innovations. And that inspires me every day. We have a highly motivated team to tackle and implement truly novel ideas together. I originally come from the energy sector. It was always a matter of first integrating renewable energies into the grids and ultimately enabling today's electric mobility. My focus is on advancing new technologies for our planet. I also look at my children, for whom I want things to go well later on. That's why I get up every day and enjoy going to the office.

Dr. Matthias Maurer: As an astronaut, of course, you are someone who is led by your dreams. All I need is to gaze into the night sky every evening and to marvel at how much there is still to discover out there. There are so many places where I want to go and where I want to learn something. The fundamental question here is: How did all that out there come about? How did life come to Earth and how did our solar system come about? Are we alone in the universe or are there other intelligent beings out there? And how might they live? These questions have a lot to do with dreams, but also with a sense of adventure and the drive to discover new things. In addition to my enthusiasm for technology as an engineer, from a science standpoint I am fascinated by the fact that I am allowed to do new experiments every day in space and look over the shoulders of the best researchers in the world. That really energizes me. And then there is the dream of flying to the moon itself. We are looking through the glass here at an Apollo situation—I would like to go there. And another motivation is to share knowledge and inspire the next generation.

Info

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Text: Heike Hientzsch
Images: Max Brunnert

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Sandro Kälin

Head of Communications Porsche Schweiz AG
+41 41 487 91 16
sandro.kaelin@porsche.ch

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