EPISODE 1 - VOKSWAGEN INNOVATION HUB

TRANSCRIPT

What do Volkswagen and the University of Tennessee have in common? In this inaugural episode of Research Park Chronicles, we learn about what exactly the Research Park is, and their informative connection to Volkswagen. Join us for Research Park Chronicles, a podcast that documents the history of, and current projects, that are being under taken by the University of Tennessee's Research Park. Sitting on the edges of Knoxville on the banks of the Tennessee River, the Research Park is working on innovations and cutting-edge technologies to a collaboration with the historically and scientifically significant Oak Ridge National Laboratory, the Research Park is at the forefront!

Links in Transcript

- UT Research Park: https://www.tnresearchpark.org/
- Volkswagen: https://www.vw.com/
- University of Tennessee, Knoxville: https://www.utk.edu/
- Oak Ridge National Laboratory: https://www.ornl.gov/

Transcript

Rickey McCallum: So, what are research parks? Why do we need them? What makes collaboration between educational institutions, public entities, and private companies so powerful and finding innovative, adaptive, and real-world solutions? This is the story of the University of Tennessee Research Park, and it's going to talk about that exact thing. So, welcome to the *Research Park Chronicles* with Rickey McCallum.

Rickey McCallum: Hello and welcome to the very first episode of *Research Park Chronicles*. I'm your host Rickey McCallum and throughout this podcast, I'm going to take you on a journey through the gateway to collaboration. We're going to talk about why university research parks are so integral to innovation, how the UT Research Park came about here in Knoxville, Tennessee, and what it's already accomplished. And in future episodes, we'll dive in even more to future projects within the park, developments between Volkswagen, which is the power behind the research park in UT, and what research parks mean in the future of scientific discovery, technologies, economies, and consumers.

But I'm getting ahead of myself here, so let's start from the beginning. I know you're all dying to know, "Rickey, what exactly is a research park, anyway?" Well, I'm glad you asked. University research parks are the physical locations developed and designed to foster an environment of collaboration between universities, the public and private sectors, and the federal research laboratories. In the case of the UT Research Park, the goal is simple: to become a bridge between science and technology companies and the best up-and-coming scientific minds at the University of Tennessee.

These are places established to enable a free flow of ideas between R&D institutes, universities, and research labs in order to solve real-world problems with innovation and cutting-edge solutions. And Volkswagen, the powerhouse German car manufacturer known for leading the

industry in innovative developments, wanted to create one right here in little old Knoxville, Tennessee. But why? The answer to that question lies 112 miles south of Knoxville. In 2008, Chattanooga, Tennessee, came into focus when VW chose that scenic southern city as the location of its first U.S. auto plant since the closure of the Westmoreland Assembly Plant in Pennsylvania back in 1988. Now, the Volkswagen Chattanooga Assembly plant builds the US-specific VW Passat and the VW Atlas.

With their own assembly plant located just over a hundred miles away, the well-established research-centric UT Knoxville at hand, and Oak Ridge National Laboratory just down the road, how could Knoxville not be the perfect location for researching composite materials?

Of course, I say that as if it makes complete sense, but when I first began researching this podcast and reading about the UT Research Park, all I could think of is, why Knoxville and how did we get so lucky?

But I had a conversation with my good friend of mine, Dr. Leon Tolbert, who works in the electrical engineering and computer science department at the University of Tennessee, and he gave me a little backstory that will put it all of this into perspective.

Dr. Leon Tolbert: So, when Volkswagen first built their plant in Chattanooga, they came to the University of Tennessee—and that was probably more than 10 years ago—and wanted to engage the university because they were looking at hiring graduates of our university, they were looking at working with faculty, and they donated, I think, a pretty substantial sum of money at that time to fund research in engineering. And so, the College of Engineering then gave out grants to faculty who were doing work related to electric vehicles and, I believe, got a couple of those grants, and worked with students on things related to power electronics for electric vehicles. But then, I guess things just kind of coasted along there for a few years, and then, more recently, a couple of years ago, they approached again wanting deeper involvement, and came and looked at the work we were doing already related to electric vehicles, visited our department several times, and then approached us about establishing a Volkswagen fellowship for graduate students, and in that fellowship, they would hire the students to work full-time at Volkswagen while they were pursuing their PhD. And this kind of follows the model in Europe where a lot of the PhD students basically are full-time employees of companies, but they're pursuing a PhD, and they wanted to do something similar here at UT.

Rickey McCallum: And they did just that. VW approached UT and created an incredible program for PhD students to work full time on research projects that directly impact real-world struggles. Now, when these students complete this program, they're going to be ready and have applicable real-world experience to show for all their hard work, and have a foundation of research already in place. So, Dr. Hendrik Mainka, project manager and team lead of UT's Innovation Hub, told us a little bit more about the PhD program.

Dr. Hendrik Mainka: Yeah, I think that the PhD program probably is pretty unique for the US. I mean, we have a PhD program in Germany at our headquarters where, always, the PhD

students are Volkswagen employees. I think that's a huge one, too, a lot of the PhD fellows here and in the US, so PhD fellows you will talk to later, they are all Volkswagen employees, and we're really working with them as our people to make sure we having this close connection, not only to the university, also for our students to really real-life problems, you know? You're working on a wireless power transfer, for example, that's something we want to see the next years being implemented in our cars.

And so, your PhD research really has a high impact. Same with the research on sizing to optimize our composite parts. That's really applied research on a PhD level, which really helps the company moving forward with the innovations, and also having the students working on real-life problems. I think that's really unique and hopefully, it's beneficial for both sides.

Rickey McCallum: It all already sounds pretty great right? A world-renowned, industry-leading auto manufacturer choosing our Knoxville, Tennessee university to start exploring composite materials for more affordable, energy-efficient vehicles we can make right here in the same state.

Yeah, it's really awesome, and it gets better. VW didn't just stop at the UT Research Park. In 2019 they announced that they wanted to use Knoxville as the site of their very first North American Innovation Hub. Now, in a partnership between Volkswagen, UT, and Oak Ridge National Laboratory, the Innovation Hub will be an extension, or rather an expansion of the Research Park, and it will further develop research opportunities for UT doctoral students with a focus on electrical engineering and developing lighter components for composite materials.

And those opportunities have already begun with the very first wave of doctoral fellows. William Henkin, a VW research fellow at the University of Tennessee, Knoxville, gave us a little more insight on just how incredible this PhD program has already been.

William Hankin: It's an incredible experience and the fact that I'm the first one kind of paving the way, trailblazing it makes me kind of smile to myself and, like I said, it's validation on everything I've done to this point. As a grad student, you don't necessarily get those feelings all the time, so you got to take advantage of it when you do. [laugh].

Rickey McCallum: trailblazing. [laugh]. I like that. That's the perfect way to describe both the program in general and your research projects and goals. What is it specifically that you're focusing on in the Innovation Hub, William?

William Hankin: Volkswagen is very interested in next-generation vehicles. And an extension of that is electrification and lightweighting. And so, a lot of the work I'm doing is in the lightweighting aspect. And so, I'm looking really at composite materials: how to make them stronger, more efficient, and how to implement them in automotive application.

So, Department of Energy here in the East Tennessee area is huge. They have the National Transportation Research Center, and they work closely with University of Tennessee, Knoxville,

so we have great supporting casts, academic, adjunct faculty, collaboration is prolific and Volkswagen really saw that as an opportunity to put down some roots in this area. And we're really the first generation of fellows here, but I expect this to grow, a lot.

Rickey McCallum: and grow it most certainly will. So, this is VW is the very first North American Innovation Hub. And as I said, it means that Knoxville is going to be joining the ranks of Berlin, Tel Aviv, and Tokyo, renowned sites for establishing VW Innovation Hubs.

It still sounds just a little too good to be true, or at least it did to me. So, I asked Associate Vice Chancellor for Research at the University of Tennessee rather bluntly, "What's up with that?"

If you look at Volkswagen's global footprint, where the Innovation Hubs and their centers and stuff are located, Knoxville's not considered a Tel Aviv or a Tokyo type of location. And so I'm curious if you have any insight of what may have been their thought process, and why Knoxville? I mean, why move here to establish this Innovation Hub?

Marc Gibson: Yeah, so that's a good question. I had the opportunity, actually, to visit their Tel Aviv hub last November and I was kind of wondering the same thing, to be honest. I was like, "That puts us in pretty, pretty prestigious company," I was really excited about that. I had an opportunity to sit down with the folks in Tel Aviv and they outlined why they're there and what the motive was for Volkswagen to locate a hub in Tel Aviv. And certainly, it was around their innovation, their startup culture that they have there, so I knew right away, it was a little bit different why they were looking into Knoxville.

I think they look at Knoxville as the future hub for materials and manufacturing. And I think there's a lot to be said, obviously, for the strengths that we have here. But I think they also looked at the vision that the University of Tennessee had and the relationship that we have with ORNL, and I think they really felt like we could move together. Together we can move a mountain and really create something special here.

Rickey McCallum: Dr. Uday Vaidya, a Governor's Chair for Advanced Composites Manufacturing at UT followed that up.

Dr. Uday Vaidya: as you know, the ecosystem here in Tennessee is very unique. We have a very large, signature flagship university, University of Tennessee, the world's largest DOE lab in terms of materials research, Oakridge Lab, just 20 miles away, the manufacturing demonstration facility at Oak Ridge, and the industry network, which combines along with IACMI which is, again, a very unique piece in this whole equation. So, the entrepreneurial aspect of it is almost natural in that because there are so many technologies that are at play, and a lot of the students and personnel work throughout, you know, in terms of progressing to a certain endpoint as part of their academic career, many of these students are extremely entrepreneurial already. But now that gives them a purpose and a real vision of where their business and entrepreneurial skills could get to.

So, we have a number of such examples of students starting companies as part of their PhD or masters training, like the Innovation Crossroads program between Oak Ridge and UT makes a very good case for these students to get seed funding and going. So, the hub that you have here, or the Innovation Hub is a key part of the entire process because now that gives a real home to these kinds of ideas to set up, whether it's a space, or an asset, or a process, or the infrastructure required for such a daunting step that they would take. So, such a thing is extremely easy because of operation like the Innovation Hub.

So, I believe it should become a very natural relationship on multiple fronts. The technology is just one piece of it. I mean, you have the manufacturing side, you have the materials side, the electrification, battery, so many aspects of Volkswagen's interests which fall within that. But alongside, there's a huge need for the workforce development and then the training, not only at the PhD level but also all the way from the technician people on the shop floor. So, you need multiple points of engagement with the company.

So, I think the vast range of programs that UT could offer, along with Oak Ridge and the ecosystem, will continue to engage VW in a continuous way. So, that will also then excite their supply chain, the tier suppliers, tier one, two, three. So, they will want to set up operations in the proximity. So, it has a cascading effect of benefit for sure.

Rickey McCallum: A cascading effect. That's the perfect way to describe the blossoming partnership that just keeps going between UT and Volkswagen. And it's certainly cascaded into some wonderful research opportunities and projects. And since Dr. Hendrik Mainka has been there from just about the beginning of the cascade, we turned to him for a little more information on that partnership.

Dr. Hendrik Mainka: The conversations, at least, I have been empowered, have started around about in 2015. I think everybody remembers when IACMI, the Composite Institute, was founded in Knoxville. Awesome event with President Obama on-site announcing the DOE-sponsored institute and, yeah, Volkswagen is proud to be a founding member of this Institute, which is basically led by University of Tennessee in Knoxville. And I think that's basically how everything started.

And in the following years, we had several IACMI projects together with UT to develop lower-cost, high-speed manufacturing, really efficient method for automotive lightweight composites. Also looked at recycling processes with UT together and the last years. And I think, really, the highlight of this project is a Volkswagen Atlas liftgate. And I think that's pretty much how it began, and how we started our cooperation with UT. And finally, in 2015, we opened the Innovation Hub in Knoxville, which is another major milestone in this development.

A big part of innovation is basically co-creation. So, if you're working with companies or experts from different fields, that basically creates a lot of innovation in the way that new ideas are trickling into your field of expertise, and we see that, for example, with some of the UT faculties where we combining fields like AI with material research, which is really kind of a new way to

create innovations. Or when we're working with experts of your Carbon Renewable Center to create really innovative materials for automotive applications. We're working with producers of paper and plastics on the other side, and then combining that to awesome new products. I think that's really where you see innovation taking place. So, it's really the capability of having all these different people available for Volkswagen to work with and have this cooperation with UT. I think that's how you might want to describe innovation.

Rickey McCallum: Throughout this whole discussion, we've heard from several different perspectives of the evolution of where the partnership came from, and most importantly, where it evolved into. But which really came first? Was it the Innovation Hub that started the conversation? Was it the liftgate project, or specific research that defined really what the Innovation Hub was going to be? Or was it neither? Don't worry, listeners, this isn't the chicken or egg scenario. We do have an answer. A good one, from Marc Gibson.

Marc Gibson: Yeah, that's a good question. So, the liftgate project was really kind of our launchpad. That's an IACMI project, led by several of our faculty members here that I think you're probably also going to talk with Dr. Uday Vaidya, and then Dr. Dayakar Penumadu. That project got off the ground and really, I think, excelled their thought process on the confidence that they would have and what we are capable of doing.

And so I think once we established that we could do the work and that we had the expertise—and that we had the equipment here. I mean, if you look at the resources that we have here, it's pretty phenomenal. On a global scale, I'm not sure that anyone in the world has the type of capabilities that we have here between UT and ORNL. The cool nuance there is essentially what they do is they identify a project, okay. And they come to us and they say, "Can you solve this project?"

And we connect them with a faculty member that we think can solve the problem. And then they create a statement of work, the faculty member goes and identifies a PhD student, and then Volkswagen pays the PhD student to go to school at UT. We're talking about the liftgate on the back of one of these vehicles. To do something like that—you know, I think Volkswagen told me at one time—and you have to ask them, but I think they told me at one time to get something like that changed and on the assembly line on one of their vehicles, it typically takes, like, five years. And, you know… we [laugh] we fast-tracked that.

I mean, you look at what we were able to do. I mean, we were able to do that really in like two to three years, and it's now going to be manufactured, going on the assembly line, and consumers are going to be able to buy vehicles that are going to be manufactured in Chattanooga, that had University of Tennessee and Oak Ridge National Laboratory technology in it. I mean, how cool is that? But you can kind of look at some of the other projects that are taking place now, too. I mean, it's not just around lightweighting and composites. Now they're moving into batteries.

One of the big things—and you'll have to ask Volkswagen a little bit more about this, but one of the big things about that plant is they've also started almost a billion-dollar infrastructure improvement slash addition, in Chattanooga—and you got to think, that plant's less than 10 years old—to do all battery work and battery research. And so they're really going to be looking at faculty members here. In fact, two of the projects that they've kicked off already are going to be housed in our Department of Electrical Engineering, Computer Science, and doing battery work. And I think that speaks volumes; they're not just here to do composites and manufacturing, but they're here to access other areas of expertise, too, which I think is pretty cool.

Rickey McCallum: So, Marc mentioned the liftgate project. Let's talk about that. It's the project that is really the main focus right now here at the UT Research Park. So, we're going to get into a little bit more details and specifics about that in one of our next episodes, but it's the first project in which the Research Park is actively working to find an innovative solution to a real-world problem.

And it is very important to Tennessee specifically because while research parks do work hard here in Knoxville to create the solution, the VW plant in Chattanooga is working hard to implement that said solution. So, the entire project from start to finish is being handled right here in East Tennessee. So, of course, when it comes to a project like that, we have to think ahead to the impact the project will have on the future. So, what does this project mean for the future of the Innovation Hub in 5, 10, 15 years?

Dr. Uday Vaidya: Sure, so in the liftgate project one type of intermediate materials have been used, but composites offer such a broad design space. It's like a painter's palette, really, you can choose a range of different things and come up with unique innovations every single time. So, it just offers innumerable possibilities for futuristic designs. So, the Volkswagen liftgate project, as you know, was one of the first signature projects for IACMI under the Composites Institute.

Volkswagen is a key company in the Tennessee area. In Chattanooga, they're producing vehicles. Most of the current vehicles require lightweighting because of possibilities for energy savings, energy efficiency, less fuel consumption, and so on, so every ounce that you save from the vehicle's weight impacts the economy in terms of its cost savings down the road. So, the whole idea from Volkswagen, currently their liftgates are made out of stamped steel, sheet metal, which is good. Excellent material, but there's a lot of potential that composites offer, such as high-impact resistance, ability to tailor, create deep draws, complex shape parts, and near net shape parts. So, we had a good potential there to use all the attributes of composites towards this application, and that's where the unique combination of IACMI, Oak Ridge, University of Tennessee, this ecosystem came into play, of course with other partners as part of this project.

So, really, all our industry-related projects are highly valuable because it provides the students and the staff working on it a real-world opportunity. So, everything they're doing has a purpose, meaning, and an actual tangible product, process, et cetera, down the road, that they can see

what their research is actually leading into. The Volkswagen project, like any other project, obviously engaged a number of students—both undergrad and grad students—towards problem solving all the way from design process, process modeling, testing, characterization, you know, the whole process of designing a part all the way to the end product, so they could actually see the fruits of the labor at different stages as it was going on. So, that led to a lot of fundamental research along the way for PhD and masters students, as well as a lot of experiential learning for undergraduate students, who had never even seen or known what composites was about, that gave them the opportunity. So, when they now put their CV together—or resume—they would have a huge impact. When they go to their interview, they can actually speak in terms of real-world opportunities they have been faced. So, it's a very valuable relation and experience.

Rickey McCallum: And of course, the liftgate project is only the beginning, only one of many projects and research studies being done in the Innovation Hub. So, Dr. Tolbert, some of the topics of discussion that we've had around Volkswagen's partnership is around technologies for future electric vehicles, including power electronics and wireless charging, what's the future of EV, in your mind, with this partnership, and how the University of Tennessee can help advance the technology and innovation that Volkswagen is looking for?

Dr. Leon Tolbert: So, I was really excited when Volkswagen approached us to talk about electric vehicles and their plans that they're doing in Chattanooga to build new vehicles, mostly because I've worked on electric vehicles since the 1990s. A lot of that was through Oak Ridge National Lab and the research that they're doing at National Transportation Research Center; they've been working on electric vehicles since the early '90s. And I really see electric vehicles, and just electrification of transportation in general, as a bright future and a trend that's global. We've done quite a bit of work on looking at traction drives using silicon carbide wide bandgap materials to electrify vehicles.

And I think, as we've seen, a lot of companies are pursuing autonomous vehicles and that's also going to require electrification of vehicles in order to be able to charge a while they park and things like that. So, we really see a bright future, and we're very excited when Volkswagen came and wanted to work with us on this.

So, at the University of Tennessee in our department, we have a wide bandgap traineeship for graduate students, and that was funded by the US Department of Energy specifically to attract US citizens to work on wide bandgap power electronics. And we've had probably more than two dozen students in that program since it's initiated, and most of them are MS students. And I think Volkswagen saw that program, saw our general strengths in power electronics, saw the tremendous amount of work being done at Oak Ridge National Lab, and came and wanting to partner with us in that area. And so they were interested in a couple of students coming out of this traineeship, transitioning to become VW Fellows and pursue PhD, and I think what we like as faculty in working with industry is we want our research to eventually end up being used somewhere. And so it really helps inform our research to make it real-world applicable.

And I think students, too, really gain a lot in working with industry because what they're working on, they hope one day will show up in a vehicle. So, I think obviously, there's lots of technologies that go into cars, and we've talked about the electrification of transportation, and so I do think there is quite a bit of room to grow in just drive train technology, there's a lot of room to grow in autonomous vehicles, a lot of room to grow in energy storage and battery technology. And I think this is a unique place, having Oak Ridge National Lab, TVA, University of Tennessee, and all of the research that goes on here. I would be remiss if I don't also mention CURENT. It's an NSF DOE engineering research center dedicated to looking at the future electric grid. And so, we have one of the top programs in the country in power systems and power electronics, and more than 100 graduate students in that area. And so, this is just really a great place for things like that.

Rickey McCallum: So, there you have it. Now you know exactly what a research park is and how Knoxville ended up not only with one but also as the home of a VW Innovation Hub. So, next time we're going to dive in a little deeper. That's right, we're going to get into the projects, specifically the liftgate project, which is the UT Research Park's first project to solve a real-world problem in the VW Atlas. And it just may have been the siren's call that drew attention back to Knoxville and convinced VW to bring their North American Innovation Hub to us. So, find out more next time in the *Research Park Chronicles*.

And thank you for listening to the *Research Park Chronicles* with Rickey McCallum. We'll pick up here next time with the rest of this story. Keep up with the latest episode by subscribing on iTunes, Spotify, Google Play, or wherever fine podcasts are found.