

Automotive

Uniti Sweden

Uniti Sweden is making electric cars that make more sense

Products

Teamcenter, NX, Simcenter,
Tecnomatix, MindSphere,
Fibersim

Business challenges

Continuously innovate electric
vehicle concepts in record
time

Create digital twins for design,
development and
manufacturing

Build three working proto-
types with an extremely small
team

Create a production-ready
vehicle design for Industry 4.0
digitalized manufacturing

Keys to success

Using design and develop-
ment tools in unique ways to
quickly iterate the design

Standardize on Teamcenter
and NX to maintain data con-
nectivity throughout the
entire development process

Create predictive engineering
models using Simcenter

Siemens solutions help a startup transform into a pioneer in digitalized design, development and manufacturing

Electric cars make sense, so why aren't we all driving them? For one, they are still expensive compared to conventional vehicles, and honestly not many are available. Then there is the whole issue of charging stations. But what if electric vehicles were reinvented so that the concept was less car, and more driving experience?

Fast forward to Lund, Sweden

Lund is one of Scandinavia's most active innovation hubs with a vibrant startup scene. It is home to Uniti Sweden, a

startup company founded by Australian native Lewis Horne in January 2016.

In only two years, Uniti Sweden has reinvented the electric car using an organic, rapid-iteration design process and a focused startup mentality. In partnership with Siemens PLM Software, Uniti Sweden is transforming from a crowd-funding startup to a pioneer in digitalized vehicle design, development and manufacturing.

An exceptional digital journey

Uniti Sweden originally started as an open innovation project at the world-class Lund University. Led by Horne, the small project team didn't start with the idea of creating a car. They looked at urban mobility issues, focusing on facts and data.



Results

Digitally designed and developed three working prototypes of Uniti One in four months

Integrated accurate digital twins into digitalized engineering and manufacturing processes

Successfully launched the product and secured preliminary orders valued at more than €60 million

"If you have 100,000 people on one highway in giant SUVs with only one driver in the car, you are going to have a problem with pollution and congestion," explains Horne, chief executive officer at Uniti Sweden. "The way to change this mentality is not to wag your finger and say 'You should drive a small car or a bicycle.' As a company, you have to come out with a product that is attractive enough to make people want to change. This is what we aimed for with Uniti One. It has a lot of space. It is safe. It is cool and exotic, but it is not 2.5 tons of machinery blocking the road."

Organically, the project team at the university grew into a small startup team, and quickly realized that the classic four-seat, combustion-engine vehicle platform wasn't ideal for modern-day urban transportation models like car-sharing and subscription services.

"It was clear that we had to go electric and that we had to make the car go a whole lot further," says Horne. "That was sort of the basis: make an electric car but make it make sense as an electric car. If you have a two-ton electric car with a ton-and-a-half battery, the battery's primary job is to move itself around instead of moving the human around. We wanted to make electric cars that made more sense."

Uniti Sweden then began to re-think the traditional idea of the car, and even further, the electric car. "The average commute in Sweden has 1.2 people in the car," says Bo Johansson, chief inventor at Uniti Sweden. So we designed Uniti One as a two-seater with a main seat in front and a smaller, simpler passenger seat behind it."

The big bang

Portuguese automotive designer and architect Marcelo Aguiar met Uniti Sweden during a call with Horne. He shared some of his sketches and ideas and several weeks later signed on to start working on designing what would become Uniti One.

"Suddenly, there was this big bang and everything got started," Aguiar says. "As a startup, especially in the beginning when everything is no budget or very low-budget, we had to solve problems in a creative way. We became very agile because of that. We used a lot virtual reality to accelerate the design process."

Early in the design process, it became clear that the Siemens digital innovation platform with NX™ software for design and its Realize Shape conceptual modeling capability would join forces with Uniti's own virtual reality solution to drive the team's hyper-speed design and development process. Using a process based on "fail-fast" iterations and collective feedback on sketches, 3D printed models, CAD meshes and virtual reality experiences, the small design team advanced quickly by using typical development tools in very different ways.



"We start with sketches on paper, and these ideas are put into our NX CAD software," says Johansson. "We create a quick mesh that we export using a gaming engine so that we can check out the design with our virtual reality headsets. We can quickly go from idea to the CAD model to virtual reality. You still get the overall 3D view, but the iteration time is a lot quicker than if you were working on physical stuff."

Innovation without boundaries

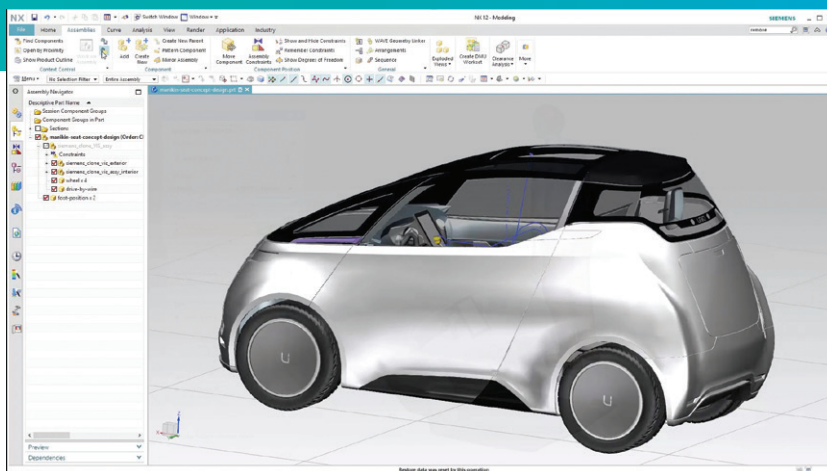
The design team at Uniti Sweden had to find a solution for the real Achilles heel of the electric vehicle: the battery. This is why the prototype weighs about 500 kilograms, has an extremely low roll resistance, and low drag coefficient. Uniti One is designed to get a whole lot more distance out of less battery without sacrificing on style. There is a roomy pod-like cabin for the driver, which is more business class than low-cost. A unique in-drive interface on a tablet does away with the traditional dashboard and, in the concept car, there is no steering wheel – rather a joystick similar to a jet pilot's.

"You literally enclose a person into an experience bubble. It is challenging, but if it is done right I think it could have a really powerful impact on the user experience," explains Kim Johansson, cognitive ergonomics design, who works closely with both the design and engineering teams. "My personal vision for Uniti One is that the technology is so well integrated that it becomes transparent when you use it. It should be natural and it should also be very fun."

That startup vibe

While the designers were polishing the pre-prototype design, Pontus Karlsson and a growing team of young engineers were involved in the design process, collectively iterating the engineering aspects of trying to get it all to fit together.

"My role was to interpret the work from the designer's mesh model and put it into



a proper model for the engineers," says Karlsson, former product development engineer. "I think if you do this type of work in NX to start, it can be very powerful."

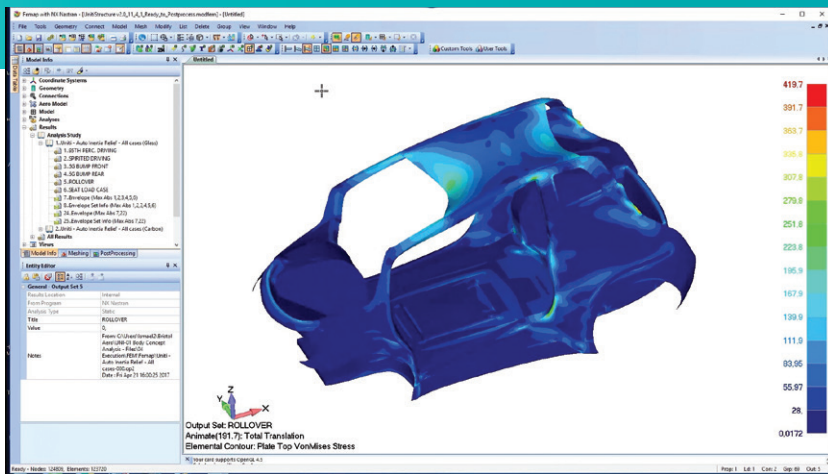
With such a young team, quite a few of the engineers were getting up to speed on the job. There were many opportunities for mistakes and errors, but because everyone was using NX, the team could become productive very quickly.

"One of the main advantages of working in NX with all systems is that all the tools just function," explains Karlsson. "You don't have the nightmare of trying to import surface models from other programs, trying to get them to fit together, having your surfaces crash and redoing all your work. With the parametric logic in NX, I can make changes later without starting over because my history tree is intact. You just have to be smart when you're using CAD."

While using NX in combination with Teamcenter® software for product lifecycle management, the team began to realize the development advantages of using a comprehensive, unified solution. Not only could they move easily from the design phase in NX to engineering analysis and simulation work within the Simcenter™ portfolio, the same model could also be used to develop the production line with the Tecnomatix® portfolio of digital manufacturing solutions.

"If you use Teamcenter, you can communicate well throughout the product lifecycle and keep all your data connected. Being successful today means having all your data connected...This connection is powerful within the Siemens ecosystem."

Pontus Karlsson
Former Product Development Engineer
Uniti Sweden



Femap simulation software was used to calculate the stress on digital twins and improve the design.

"If you use Teamcenter, you can communicate well throughout the product lifecycle and keep all your data connected," Karlsson adds. "Being successful today means having all your data connected, because if it is not connected, it is not useful. This connection is powerful within the Siemens ecosystem."

While the digital twin was advancing, the startup engineering team started to use specialized simulation tools from the Simcenter portfolio to validate the performance of the design as it evolved. For example, Femap™ software and NX™ Nastran® software were used to calculate the stress on the virtual prototypes and verify and improve the design, while

Simcenter STAR-CCM+™ was used to simulate the aerodynamic performance of the vehicle.

When the design was ready to go, Uniti Sweden sent the parts and components out for production and the real work began. Working 24/7 shifts and sleeping in the makeshift hostel off the workshop floor, an extremely small team of 15 to 20 people built three working Uniti prototypes in an amazing four months.

To the market, literally

Designing and building three cool, crowd-funded prototypes in less than four months wasn't enough for Horne and the Uniti team. Following the official launch of the prototype in December 2017, the team put the car in two popular consumer electronics retail stores to concretely validate it.

"Very early on, we engaged the customer in the design process via social media, crowd-funding and our virtual reality experiences," Horne explains. "We got thousands of people involved to develop the interfaces and see what their reactions were. We never told them how to drive it or how to use it; we just wanted to see if it was intuitive and we built on the design from there."

"The Siemens ecosystem is like one huge box of chocolates for engineers. There are so many great tools to choose from: Fibersim for hybrid composite work; NX to ensure the overall functionality; the Simcenter tools for advanced engineering."

Sally Povolotsky
Vehicle Development Director
Uniti Sweden

As a small company considering vehicle manufacturing, Uniti Sweden had to make sure that enthusiastic consumers-to-be would make long-term financial commitments. "This is why we took our first pre-orders online and in two MediaMarkt stores in Sweden," Horne adds. "Do people want to wait years for this? Do they really want to buy it?"

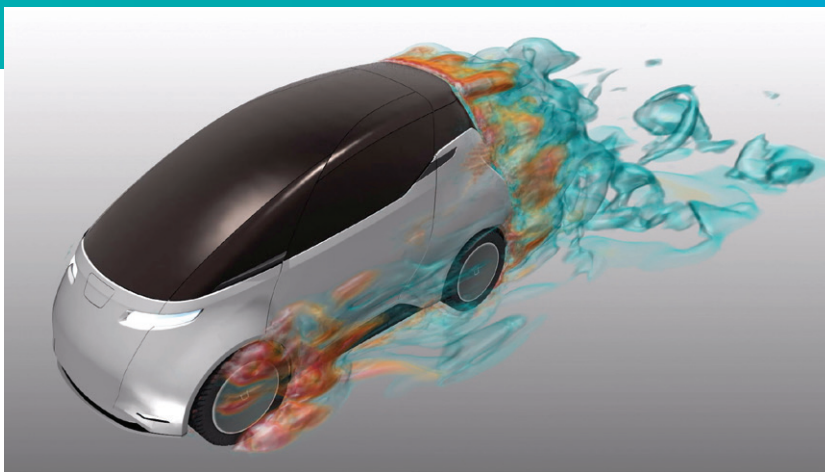
During its first test run, Uniti Sweden took 2,500 orders. Attending an event in India with the car landed another 500 orders. Today, customers can order a Uniti One online with a €149 down payment. The company had more than €60 million worth of preorders. It was time for the next big step: creating a production-ready vehicle.

A whole new ballgame

With orders flowing in and the vehicle prototypes complete, Horne knew that the company had to shed its startup skin. Engineering a prototype was one thing, but engineering a production-ready vehicle, well, that was a whole new ballgame. Uniti Sweden was going to need some help.

This is when Sally Povolotsky entered the picture. As vehicle development director at Uniti Sweden, she brings some serious automotive experience, including motorsports and major OEMs, to the table. But what appealed to her as a car fan and engineer was the fact that Uniti Sweden wasn't afraid to reinvent the rules.

"Uniti Sweden is the type of company that lets you rethink everything that you do," Povolotsky says. "As an engineer, you can ask, 'So what would I change?'" She adds, "This is such an exciting time in the automotive industry. We have the technology and the innovation in design, and the public is ready to adapt to electric vehicles. This is the right time to be a new car company in the global automotive space. I can completely see myself commuting to work in this car. It is the ideal car for modern society."



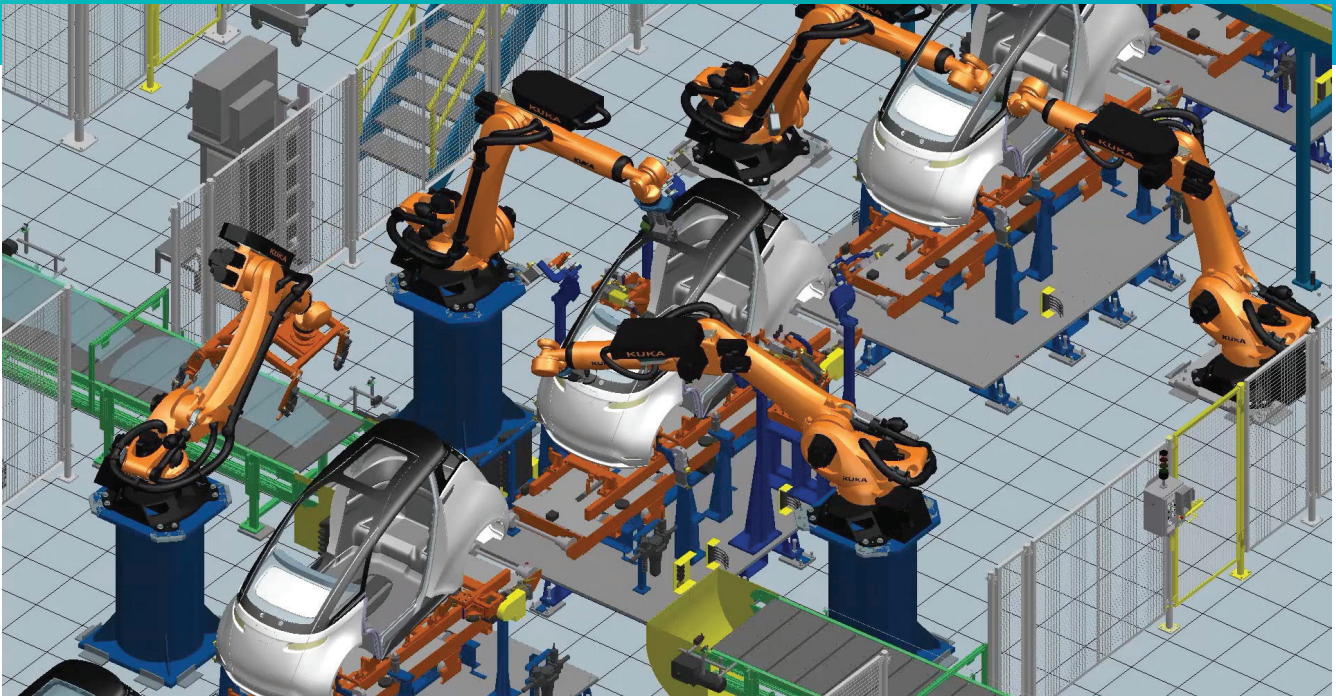
Simcenter Star-CCM+ was used to simulate the aerodynamic performance.

Povolotsky is busy at the moment forming a team of experienced engineers to take the early prototype design and work it through full engineering programs to get to "Job 1," which is industry-speak for the first car off the production line. At the moment the U.K.-based team is going through the feasibility stage and reviewing the existing data, designs and legislation in various markets. After this, the team will start to create an engineering-level digital twin using the Siemens ecosystem.

"The idea is to drive the digital twin in real performance situations: how will it perform when it is hot out? Or in freezing temperatures? Or with five kilometers left on the battery?" explains Povolotsky.

The goal is that the Uniti One will be a completely approved car, which means it will have to undergo roadworthiness, safety and crash test certification processes for various markets.

"The Siemens ecosystem is like one huge box of chocolates for engineers," says Povolotsky. "There are so many great tools to choose from: Fibersim for hybrid composite work; NX to ensure the overall functionality; the Simcenter tools for advanced engineering. We will certainly be able to rewrite the rule book in regards to how we are going to engineer our production car."



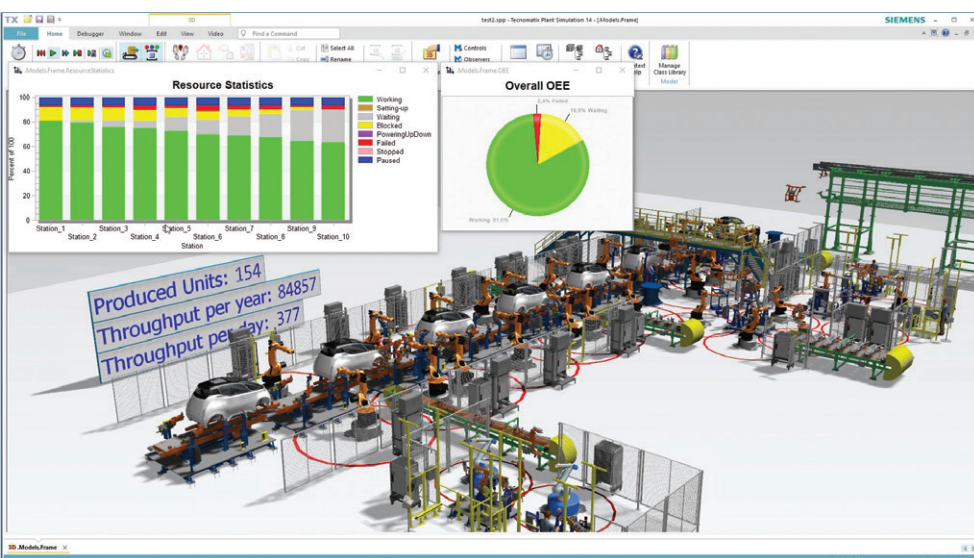
Industry 4.0 production could be ready by 2020

Uniti Sweden has seriously started its journey to make a production-ready version of Uniti One. But how does a small Swedish startup succeed in making the jump to digitalized Industry 4.0 automotive OEM?

"The main piece of value that is created from designing a car right through to mass production isn't real-world operation – that is actually the low-value part of the chain – it is the digital blueprint, the data and the know-how: from the CAD file and the simulation work to the digital factory and the cost modeling," Horne explains. "Even if we don't know how to do all these steps ourselves, we do own the Siemens PLM platform. All of our partners can conduct their roles within the platform using Teamcenter. Everyone can be working seamlessly together – even if it is a global operation. We can own that data and bring in everybody else for their role."

The Uniti Sweden team is now exploring additional Siemens solutions, including MindSphere, the open IoT operating system, and the Tecnomatix® portfolio of digital manufacturing solutions. The team plans on creating an interactive digital twin of each vehicle and the factories as well.

"Just think how much leaner you can make global production if you have a mother factory and satellite factories," Horne explains. "You can simulate the working factory first. You can do all your cost modeling and confirm all the logistics before you actually spend millions building it."



In addition to developing a digital twin for the production line in Tecnomatix, the team counted on advanced engineering simulation tools from the Simcenter portfolio, like Femap software, to examine detailed performance functionality within the digital twin as well as Simcenter Star-CCM+ to simulate the aerodynamic performance.

Solutions/Services

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“Not to mention what localized production can do for your carbon footprint,” adds Povolotsky. “Today, OEMs are still shipping cars around the world. As a new-generation OEM, we are looking at reinventing the production process as well. If you order your car in the UK, it will be made in the UK, or maybe just across the channel in France. There will be a no-waste policy and all types of innovative recycling, second-life and regenerative factors.”

Wildly more efficient...for the planet

The data revolution at the core of Industry 4.0 doesn't stop with the digital twins of the Uniti Ones or even Uniti Sweden's

digital factories – the entire digital back-end can also be connected to the energy grid, the road infrastructure, buildings and urban environments.

“Globally, it is not just about the data that we create with the Uniti One, it is the net data created by humans that we get to be a part of,” Horne emphasizes “And digitalization makes the whole process wildly more efficient. We are not talking about a small gain in efficiency, we are talking about a big enough gain that a small startup from Sweden can even have a chance at trying to develop a new electric vehicle.”

Customer's primary business

Uniti exists to meet the challenges of global mobility by producing safe, clean and affordable vehicles that balance the environmental and sustainability needs of society with mass market desires for progressive design and a premium experience. Uniti's 100% electric vehicle, the Uniti One, was first introduced at the company's U17 product launch event in December 2017. It has since gained a pre-order value totaling over €70 million.
www.uniti.earth

Customer location

Lund

Sweden

“...digitalization makes the whole process wildly more efficient. We are not talking about a small gain in efficiency, we are talking about a big enough gain that a small startup from Sweden can even have a chance at trying to develop a new electric vehicle.”

Lewis Horne
CEO
Uniti Sweden

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