Order Your Own Vehicle Microfactory

French startup Gazelle Tech creates modular, composite cars for assembly

By Robert Grace

Gael Lavaud wants to help developing countries produce their own affordable, eco-friendly vehicles. But the founder and chief executive officer of Gazelle Tech in France is taking a novel approach to doing so.

The 6 year-old firm and its partners have developed an innovative, modular vehicle that uses a composite chassis and body technology that weighs only 1,650 pounds--or about half that of current comparable vehicles. Dubbed the Gazelle, these cars are said to consume about 40 percent less energy when in use due to their light weight, while maintaining comfort and security.

Gazelle Tech initially plans to offer both gas and electric versions of its car for the business-to-business (B2B) market in its native France, and for five countries in northern and central Africa, as well as in Brazil. By B2B market, Lavaud means they aim to sell to organizations and local authorities that want to promote their sustainable mobility and reduce the ownership costs of their fleets.

A hydrogen-powered model is also planned, Lavaud said in an interview in Las Vegas in early January at the CES 2020 show, on the booth of ESI Group, one of his partners. He noted that the same Gazelle chassis can receive both gas and electric engines.

Paris-based ESI is a supplier of virtual prototyping software and services, and Gazelle Tech applied the

Gazelle Tech founder and Chief Executive Officer Gael Lavaud talked up his company's plans on the CES booth of software partner ESI Group. Courtesy of Robert Grace

Gazelle Tech's modular microfactories ship in six 20'-long by 8'-wide shipping containers and cover about 1,075 square feet when assembled into an office and workshop area. (left) The microfactories are spacious enough to allow for assembly of the entire car. (right) Courtesy of Gazelle Tech

firm's flagship software, called ESI Virtual Performance Solution, to reduce its development costs. By doing so, Lavaud said, "We were able to validate the performance of our innovative composite vehicle virtually before we even manufactured the first real prototype."

Shippable, Modular Microfactories

But Lavaud's vision doesn't stop with the car's design. Gazelle Tech also has created a modular microfactory to manufacture these vehicles--a production cell that can be shipped to the desired location in multiple shipping containers, and set up locally, to enable production in the markets where the vehicles are needed.

Lavaud said the company secured €1.1 million ($1.2 million) in funding last November that "will allow us to run through the homologation process by the end of 2020," allowing the Gazelle to be fully accredited for safety. The firm's funding partners include EPIC BPI-Groupe (BPI is the acronym of Banque Publique d'Investissement)—a French government agency that exists to help fund innovative ventures—and the regional government of Nouvelle-Aquitaine in southwestern France.

Gazelle Tech developed and patented the composite chassis technology it calls Aerocell. Lavaud would only reveal that it's a fiberglass-reinforced thermoset resin, noting that they are currently using a hand lay-up process to make the components. Using this material dramatically reduces the car's weight—which accounts for roughly 75 percent of a vehicle's energy consumption.

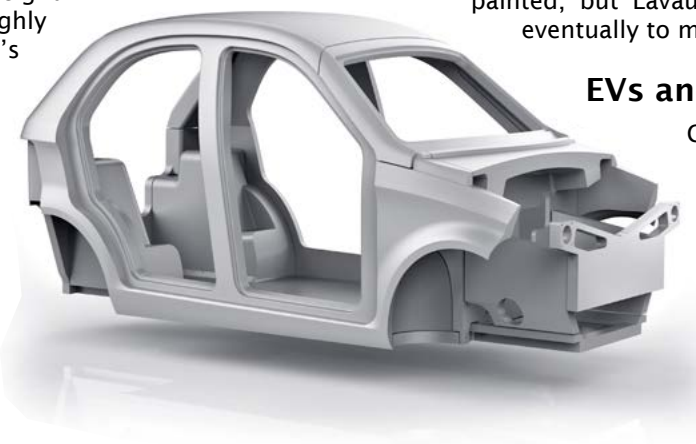
Gazelle Tech makes the body-in-white chassis, which consists of just 10 parts (compared with 300 on a typical car), including the base structure, the side panels and roof--and can be assembled in one hour. It could have made the chassis as a single piece, Lavaud said, but they specifically designed it instead to be able to be disassembled and reassembled to facilitate flat-packed, cost-effective shipping.

"We expect the materials to change over time," Lavaud said. Given its thermoset composite material, the car is not fully recyclable now, but Gazelle Tech plans eventually to convert the chassis to thermoplastic-based composites, though Lavaud currently doesn't see that happening before 2023. And the company also is constantly searching for more sustainable, natural fibers to use, other than glass fiber.

"Next will be to move from hundreds of parts to thousands of parts," Lavaud said. The Gazelle is designed to be an urban vehicle, capable of speeds topping out at 60 to 65 miles per hour.

The company made its first prototype, a five-seater, in 2015 with the African market (specifically taxi fleets) in mind. In mid-2018, during an interview at JEC's Future of Composites in Transportation conference in Chicago, Lavaud said the target price, at very low production volumes, was then about €17,000 ($18,600) for the basic model.

Customers can choose the color with various upgrade options available, including air conditioning, power windows, and central locking. The early models are being painted, but Lavaud said the goal is to transition eventually to molded-in color.



The Gazelle body-in-white chassis consists of just 10 lightweight composite pieces, and can be assembled in an hour. Courtesy of Gazelle Tech

EVs and Solar Power

Gazelle Tech's first model was gas-powered and, in early February, introduced its first all-electric

model at the Festival Automobile International in Paris. The car included a prototype of an automated, flexible solar cover that unrolls upward from behind the rear bumper and contains six embedded, rectangular solar panels. The cover is drawn up over the roof and front hood like a tarp. The car cannot be driven with this solar blanket in place, as it obscures all the windows of the car.

Gazelle Tech worked with a Paris-based firm called ACPV SAS that holds a patent on the automatic cover system. ACPV then applied to that cover some thin, flexible solar panels made from film called ASCA® made by Armor Group of Nantes, France. Armor calls its ASCA film "an organic photovoltaic solution" that is lightweight, flexible, semi-transparent, free of rare-earth, and toxic components, and produced via a low-carbon process.

Gazelle Tech displayed this prototype solar cover at a recent Paris auto show. It rolls upward from behind the rear bumper to cover the car and potentially provide additional driving range by charging the battery from the cover's flexible solar panels. Courtesy of Gazelle Tech

Made of semiconductor compounds based on organic polymers, ASCA film consists of fine layers of ink deposited using a coating process designed for thin and flexible films that offers benefits such as flexibility, lightness, and other advantages. Armor—which commercialized production of ASCA film in late 2016—claims the film is 30 times lighter than alternative technologies and can be rolled up at least 50,000 times without any loss of efficiency.

The solar panels themselves for this application are still in development. Current versions can charge an EV's battery enough to allow the vehicle to travel an additional 12 miles per day, but Lavaud says he expects the range of that solar-panel charge to double to closer to 25 miles per day within the next two years, when he says that option may be available. Meantime, he notes, "We are also considering

The first gas-powered Gazelle carries a price tag of just under $19,000, but that should come down once production volumes scale up. Courtesy of Gazelle Tech

to use rigid solar panels that already produce the 40 km [25 mile] per day range."

"As average travel in France is 38 km a day [23.6 miles]," according to Lavaud, "we can target energy autonomy with this solar version. But this option will come after homologation, probably in late 2021." The Gazelle EV's current battery range (without the solar boost) is about 112 miles.

For the upcoming EV model, he sees an initial target price of €20,000 to €25,000 (about $21,800 to $27,300 at current exchange rates) with Gazelle Tech currently making only about 50 vehicles a year. But he anticipates that price coming down significantly once manufacturing scales up.

Lavaud noted at CES that Gazelle Tech plans to build three more such prototype electric vehicles, in addition to the one they just completed. Those cars then will need to go through crash tests and other certifications. ESI software also can be used to help simulate crash-test results.

Gazelle Tech's Business Strategy

Gazelle Tech intends to focus on designing and homologating cars but not assembling them. Rather, Lavaud says his company will make money by selling microfactories, components, and spare parts to car dealers and entrepreneurs alike, as well as by offering training for assembly to those customers.

Some modest customization will be available on the basic models, or a customer can pay the company to create a new, custom model. It will make a "small commission" on each car that is assembled.

With more than $1.2 million in funding secured, and some sustainability awards in hand, Lavaud has ambitious plans for Gazelle Tech. Courtesy of Arthur Pequin for Magnetic Bordeaux

Customers can choose the vehicle's color, with various upgrade options available, such as air conditioning, power windows, and central locking. Courtesy of Gazelle Tech

Gazelle Tech's modular microfactories ship in six 20' long by 8' wide shipping containers—two are used for office space and four for the workshop area. This air-conditioned steel shell, covering about 1,075 square feet, is "like a big shed, with some standard tools." No specialized tools are needed. ESI Group also provides virtual reality software that Gazelle Tech used in fine-tuning assembly of the cars in its microfactories.

Each microfactory will cost about €250,000 ($273,000) and be capable of producing up to 200 vehicles per year. This approach supports local industry and sustainable mobility while also helping to create qualified jobs in those locations. Gazelle Tech plans to set up its first franchises in France and Africa next year and leverage its technology to develop other custom vehicles in the coming years.

Meantime, others are taking notice. At the 10th Annual Sustainable Innovation Forum last December—held in conjunction with 2019 United Nations' climate change conference known as COP25—Gazelle Tech took home Innovator of the Year 2019 honors from the group's Sustainable Innovation Hub. And the company garnered more attention by being featured prominently on the ESI booth recently in its first appearance at the huge CES consumer technology show.

Much more testing and development is on the schedule this year for Gazelle Tech, as Gael Lavaud prepares to propel his concept beyond his home country. Assuming all goes well, he said "we hope to do our first commercial shipment in early 2021."

ABOUT THE AUTHOR

Robert Grace is a writer, editor and marketing communications professional who has been active in B2B journalism since 1980. He was founding editor of and worked for 25 years at Plastics News, serving as editorial director, associate publisher and conference director. He is now both editor of SPE's *Journal of Blow Molding* and a regular contributor to various outlets. A long-time member of the Industrial Designers Society of America, he runs his own firm, RC Grace LLC, in Daytona Beach, Fla., and can be contacted at bob@rcgrace.com.

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