

# ARCHIMEDE 2.0

Second Solar Car









# DESIGN

BETWEEN CREATIVITY AND NEW TECHNOLOGIES



INSPIRED BY THE PAST, WITH A LOOK  
TO THE **FUTURE**



**A little bit artists, a little bit scientists.**

**Archimede 2.0, design between creativity and new technologies.**

Inspired by the past, with a look to the future, to remember where we started from with a vision of future horizons, Archimede 2.0 was born from the pencil of Lorenzo Amato and the synergy of a group of students, teachers and automotive and technology enthusiasts, to support the scientific and personal growth of students and young people who will be called to make important decisions in the near future. The project is carried out with the support of companies investing in innovation while respecting the environment and believing in the strength of the new generations.



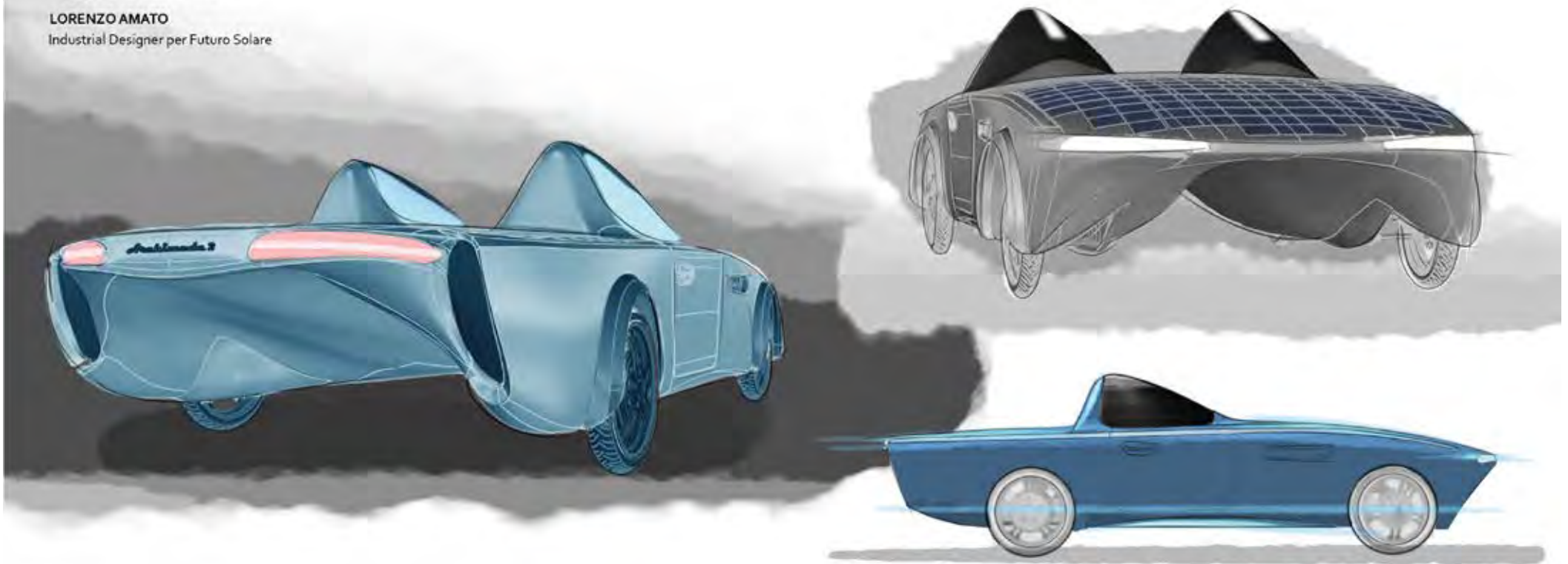


**“Archimede 2.0 is a journey through time.**

**A shell inspired by the design of the past and welcoming the future with elegance and functionality”.**

*Lorenzo Amato*

LORENZO AMATO  
Industrial Designer per Futuro Solare



### The style

The sinuous and powerful lines, inspired by competitions, the unique spirit of the exterior design continue in the passenger compartment, deliberately minimalist, to fully respect the philosophy of essentiality. The tail is high and aerodynamic but with a simple and geometric design. The two-seater passenger compartment, combining sportiness and elegance, but also classic and modern elements characterize Archimede 2.0. There are two small deflectors in front for the driver and passenger and two rear roll bars integrated in the rear aerodynamic profiles. Two important front air intakes provide for the cooling of the passenger compartment and of the electronic parts. Archimede 2.0 wants to be the turning point between the prototypes and the cars we will be driving in the coming years.

### The Personality

It will be respectful of the environment. Safe, quiet, beautiful, aerodynamic and connected, Archimede 2.0 represents the future of sustainable mobility: in the coming years, we want to be the forerunners in the creation of a vehicle equipped with environmentally friendly technologies, geared towards efficiency and reduction of consumption and CO2 emissions, with the lowest Carbon Foot Printing achievable with current technologies







## What is a car made of?

Archimede 2.0 is also innovative in terms of its construction quality. It is largely composed of carbon fiber, aluminium parts, and recycled materials, and it also incorporates bioplastics made from hemp and flax, enhanced with food waste from tomatoes and cornstarch. Archimede 2's fabrics come from sustainable productions and alternative fibers like nettle and straw, and tanned leathers that use a woody base. The vehicle boasts an 80% recycling rate and a low carbon footprint on our planet.

The significant difference and innovative contribution compared to regular cars currently on the market, which are made of steel, glass, and difficult-to-recycle plastic materials, sets us apart with our commitment to environmental sustainability.

### Low cost electronics and instrumentation

Arduino, Teensy, x86, Nucleo are the names of the boards that make up Archimede 2.0. Thanks to the simplicity of use and the release with an open source license, they are the most used tools in schools, research institutes, small companies or by artisans to carry out innovative and interactive projects. Ultra-connected to the world around it, Archimede 2.0 is in full harmony with the driver and passenger. The moment you approach, thanks to the Keyless-Drive Hands-free card, it opens the doors to a universe that combines technology and simplicity. The instrumentation gains in modernity and ergonomics thanks to its new 7" TFT driver screen with retro-style analogue instrumentation, which puts all the information the driver needs while driving within an easy reach, while the steering wheel and its functional controls allow you to control Archimedes 2.0 with the fingertips. The passenger will have a 10.3" screen in front of his seat, with the new Android Auto system providing weather forecast, real-time solar coverage and all the additional information to be a true co-driver.





#### **Mechanical safety**

survival cells, anti-intrusion bars and carbon tubulars roll bars, 4-strut safety belts and bucket seats.

#### **Battery**

20 kW of energy made with 1576, 18650 cells.

#### **Frame**

honeycomb panels of aluminum and Axial squares carbon.

#### **Suspensions**

at the front an articulated quadrilateral. At the rear a single transverse swinging arm made of avionic aluminum alloy and carbon fiber.

#### **Brakes**

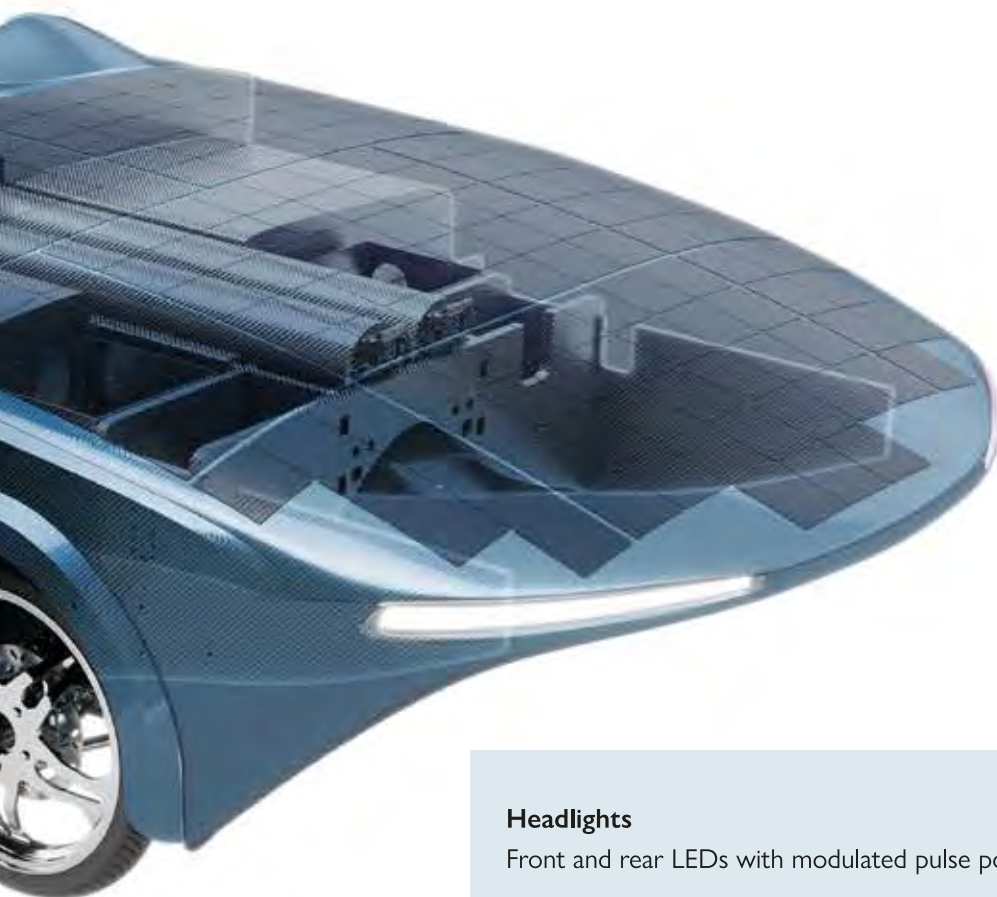
250 mm self-ventilated discs and 24 mm 2-piston brake calipers, assisted by ABS system.





### **Electrical safety**

electrical disconnection from the outside and inside of the car, quick battery extraction.



### **On board recharge**

3.7 KW charger with standard type 2 socket.

### **Solar Array**

1200w of energy produced by silicon photovoltaic cells with an efficiency of 24%.

### **Headlights**

Front and rear LEDs with modulated pulse power supply.







### **Suspensions**

The racing-derived suspension layout was developed to offer maximum performance and driving fun with attention to comfort. To achieve this result, noble materials such as an aluminum alloy of avionics origin and carbon fiber were used. Archimedes 2.0 adopts an articulated quadrilateral pattern at the front, which returns excellent feedback to the rider; at the rear, a single transverse swinging arm ensures maximum grip and traction even in the most extreme maneuvers.

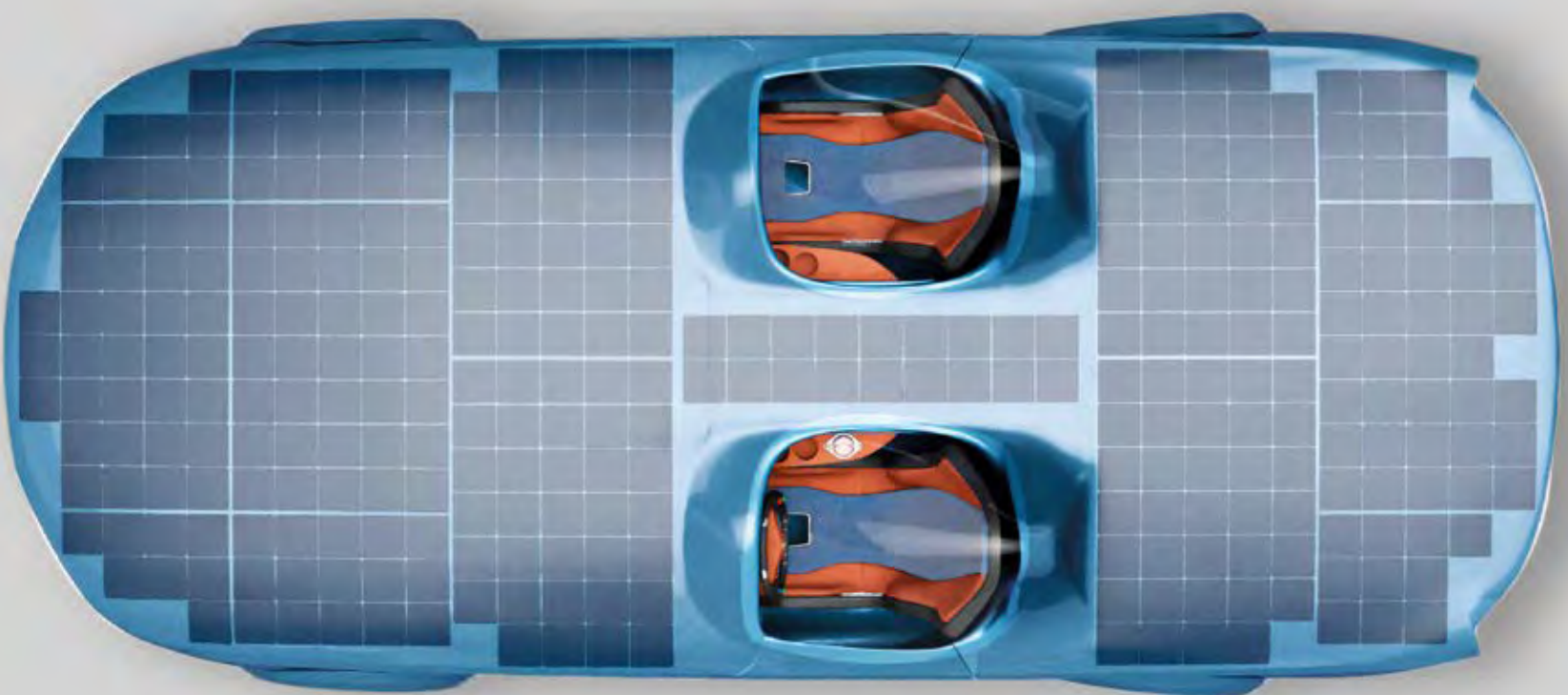
### **Braking System**

The braking system is made with floating discs with a diameter of 250mm and calipers with two opposing 24mm pistons.

The mechanical pumping elements are assisted by an ABS system, which guarantees maximum braking efficiency even in the most extreme conditions.

### **Frame**

The watchword is lightness! Carbon fiber is used throughout the car's chassis sector. This natural element offers considerable advantages compared to its direct competitors often used in the automotive field, in fact, the carbon fiber, skillfully worked, achieves a performance even 5 times better. Low-density composite materials are also used in the construction of the external bodywork, since they guarantee not only a weight reduction of 20%, compared to commonly used sheets, but also an excellent smoothness of aerodynamic flows, enhancing aerodynamic performance.





## **Safety**

Particular attention was paid to the passive safety of Archimede 2.0. Survival cells, anti-intrusion bars and roll bars in pultruded carbon tubes guarantee your safety by absorbing and reducing violent impacts up to a force equal to 5G. The 4-strut seat belts and bucket seats firmly secure rider and passenger.

## **Engines**

The peculiar idea is changing the way electric cars work to make them even more efficient. Two electric engines with a nominal power of 6 KW and 150Nm of torque are inserted directly inside the rear wheels, allowing you to reduce consumption and increase the reliability of the vehicle, thanks to the reduced complexity of the mechanics.

## **Battery**

The issue of safety in lithium batteries always attracts the attention of users and manufacturers. The particular type of container used in Archimede prevents the possibility of accidental contacts between non-equipotential charging elements, an internal carbon structure allows a very high mechanical resistance while a thermal control system prevents heating peaks as well as a complex management system BMS electronics that parameterizes all cell functions in real time, inhibiting the system in case of malfunctioning. The batteries can be removed from the car in a few seconds, automatically isolating the car and passengers from the power supply.

## **Solar Array**

Archimede 2.0 takes its origins from the energy of the sun, with its 320 ultra-high efficiency SunPower™ silicon cells. These provide the energy to travel and charge the batteries. The cells encapsulated within ultralight polymers acquire characteristics of flexibility and strength and are the best in low light efficiency and high temperature sensitivity. For this reason, the power decrease coefficient with temperature is 25% lower than that of the other crystalline cells. The electrical contacts form a very dense double comb on the back of the cell giving an optimal management of microfractures, without loss of power.





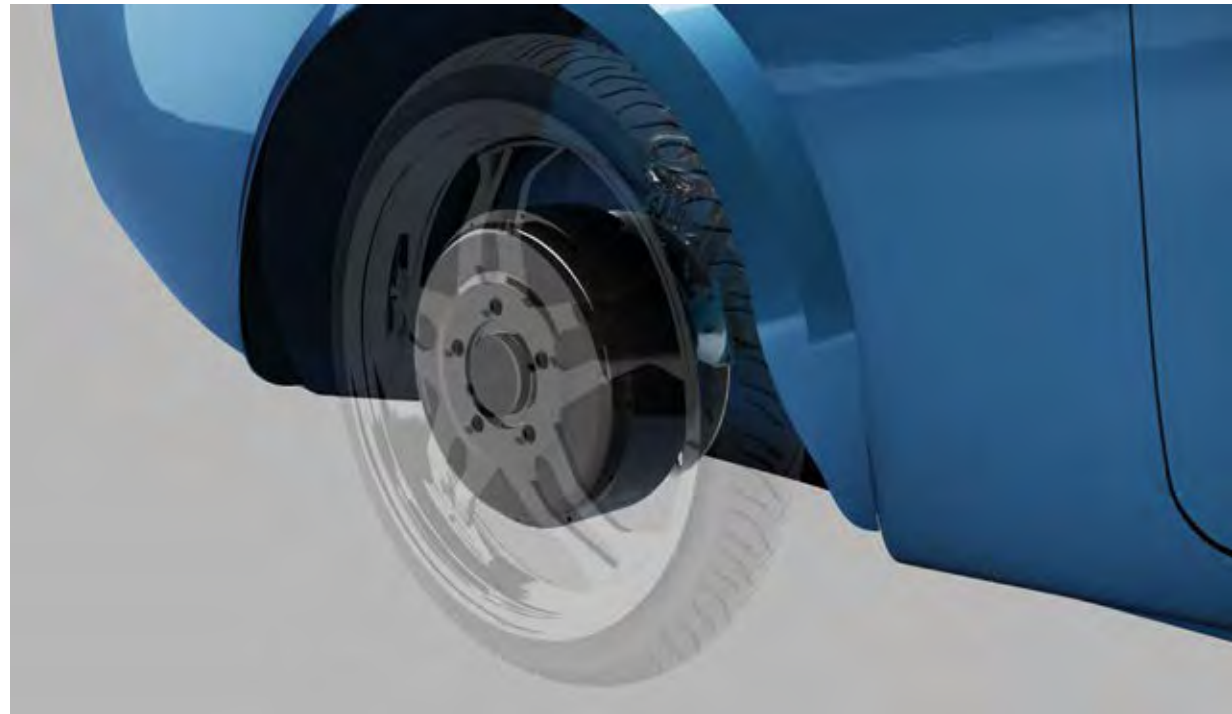
## ***“Nothing is created, nothing is destroyed, everything is transformed”***

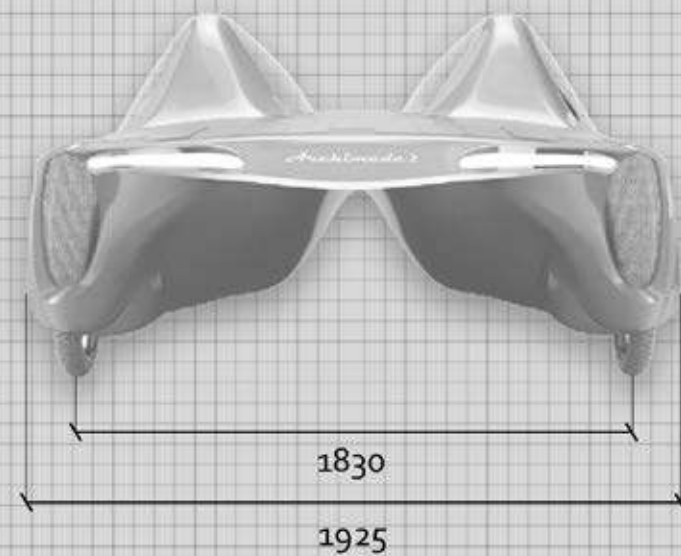
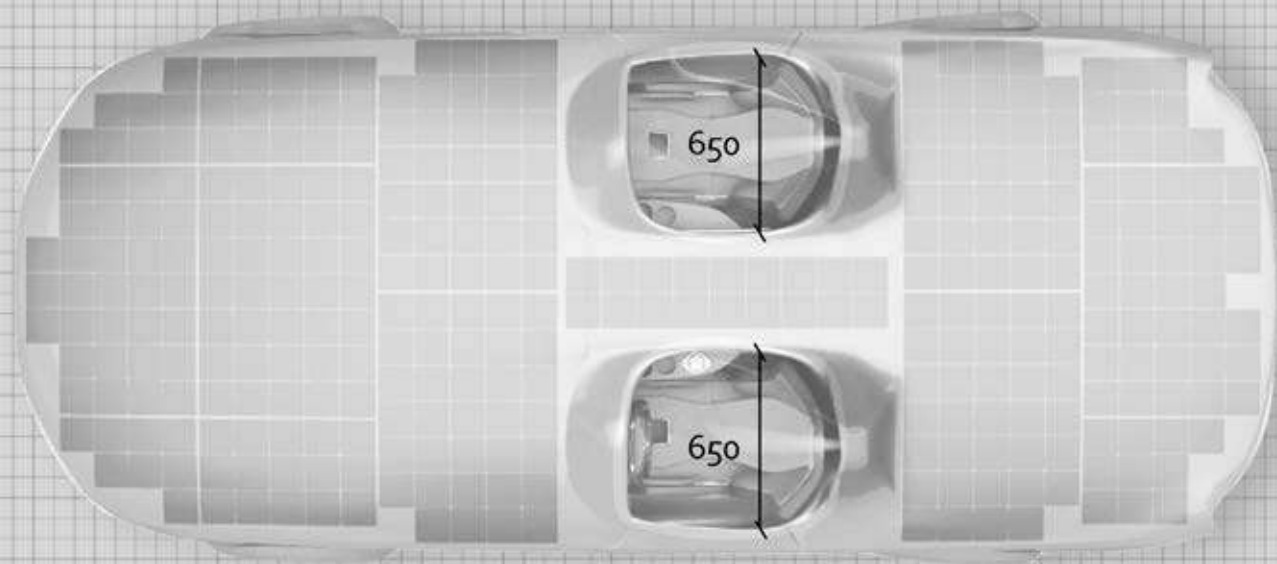
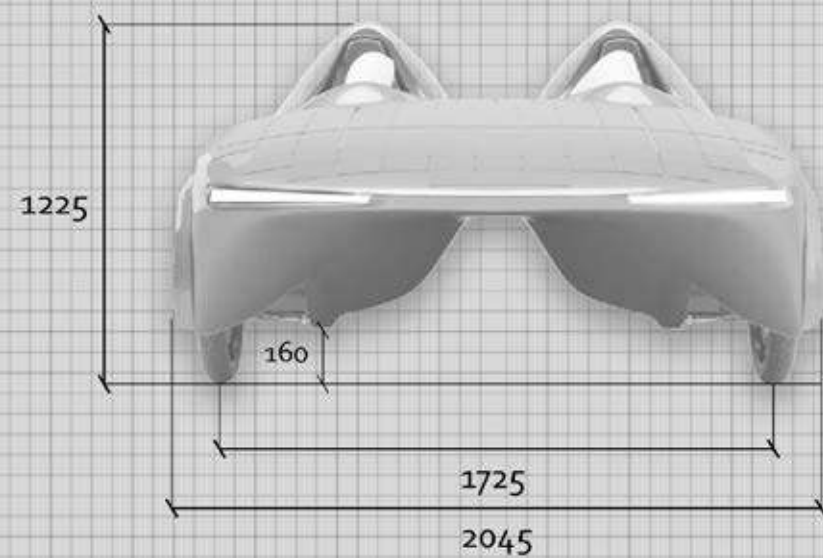
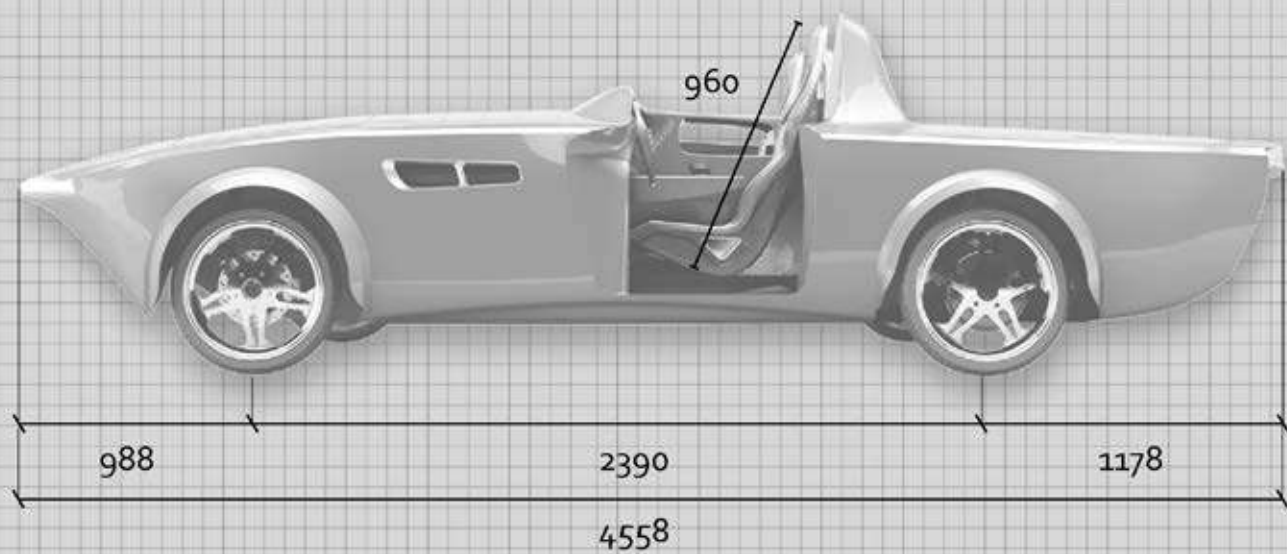
Regenerative braking uses an electric vehicle engine as a generator to convert much of the kinetic energy into charging for the batteries. An innovative algorithm has been developed for Archimede 2.0 which allows the driver to select the regenerative value through a button on the steering wheel. The presets are determined by the position of the accelerator pedal and the brake control via linear actuators.

### **“Traveling using as little energy as possible”**

Cruise control allows you to adjust the speed and automatically proceed with a cruising pace. This system, normally used in all passenger cars has its negative points, such as a high energy consumption which varies according to road conditions.

Archimede 2.0 is equipped with a Cruise control managed by the pilot with the assistance of the on-board computer, where the constant is not the running speed but the power absorbed by the engines. This has the great advantage of perfectly managing the vehicle's energy consumption.







## Technical features

### Dimensions

Max length (mm) 4558  
Max width (mm) 2045  
Max height (mm) 1225  
Wheelbase (mm) 2390  
Front track (mm) 1725  
Rear track (mm) 1830  
Front overhang (mm) 998  
Rear overhang (mm) 1178  
Minimum height from the ground (mm) 160

### Trunk

Luggage compartment capacity (front) 161 L  
(rear) 89 L

### Places

2 front (Driver + Passenger)

### Weights

Unladen mass (kg) 290  
Mass at full load (kg) 450

### Electric motors (permanent magnets)

Single engine Rated power kW (hp) - 6 (8.16)  
Max torque (Nm) - 151  
Maximum System Power kW (CV) - 12 (16.32)  
System peak power (10 sec) kW (CV) - 20 (27.2)

### HV batteries (Lithium Ion)

Rated voltage (V) – 103.6  
Nominal capacity – 20.8 KWh  
Nominal power 15KW  
Peak power 29KW

### Solar Panel

Cell number 320  
Rated power (W) at 25 ° 1040  
Peak Power (W) at 25 ° 1221

### Inverter

Three-phase Mosfet technology with Can-Bus control  
Air cooling  
Phase current > 300 A  
Working voltage > 96V

### Suspensions

Forequarters Articulated quadrilaterals and superimposed arms  
Rear Single swinging arm

### Steering

Direct rack  
Turning circle (m) 17 "wheels 12.4

### Transmission

Dual Motor rear-wheel drive

### Performance, consumptions and emission

Max speed (km / h) 120  
Acceleration 0-100 km / h (sec) 13.6  
CO2 emissions (g / km) 0  
NOx emissions (g / km) 0  
Consumption 30Wh / km at 40 kmh (with average solar radiation 10 hours 600 W / m<sup>2</sup>)  
Consumption 76Wh / km at 80 kmh (with average solar irradiation 10 hours 600 W / m<sup>2</sup>)

### Wheels

Rims 17 "  
100/80-R17 tires







### Sponsor tecnico LENOVO

La passione per la tecnologia motiva la nostra associazione da anni, in Lenovo abbiamo trovato un team con la nostra stessa visione del futuro ispirato e dedicato ai giovani.

Nella nostra terra, la Sicilia, abbiamo sancito il legame tecnico insieme a Lenovo che ci ha fornito strumenti indispensabili per la realizzazione di Archimede 2.0.

### Strumenti

Abbiamo ricevuto materiale tecnico professionale che comprende una work station P620 con le seguenti specifiche:

TR Pro 3955WX 3.9G 16C

RTX3080Ti 12GB H+3DP LE EMEA

inoltre abbiamo ricevuto due laptop della serie ThinkPad E15 Gen 3 per un budget complessivo importante.

Contrariamente a quanto si possa pensare la progettazione di un veicolo ad energia solare non passa soltanto attraverso la meccanica e l'ingegneria ma è fondamentale avere stazioni di programmazione come quelle Lenovo per portare avanti test con rapidità ed efficienza.

Futuro Solare ringrazia ancora Lenovo per il fondamentale supporto alla mobilità del futuro con Archimede 2.0.



## Media

Rai 3's **Report** team led by **Michele Buono** played a key role in the Archimede 2 project. Through in-depth interviews with our main sponsors and team members, they bring focus on the perspectives and motivations in favour of this initiative.

Thus, they contributed significantly to the communication of the project on the national network, attracting the attention of a wider audience and raising awareness of crucial issues related to solar energy and sustainability.



**REPORT**



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## Bronze



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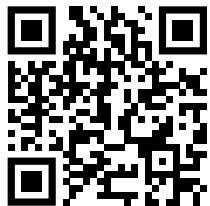
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