GRAPHENE FLAGSHIP

graphene-flagship.eu

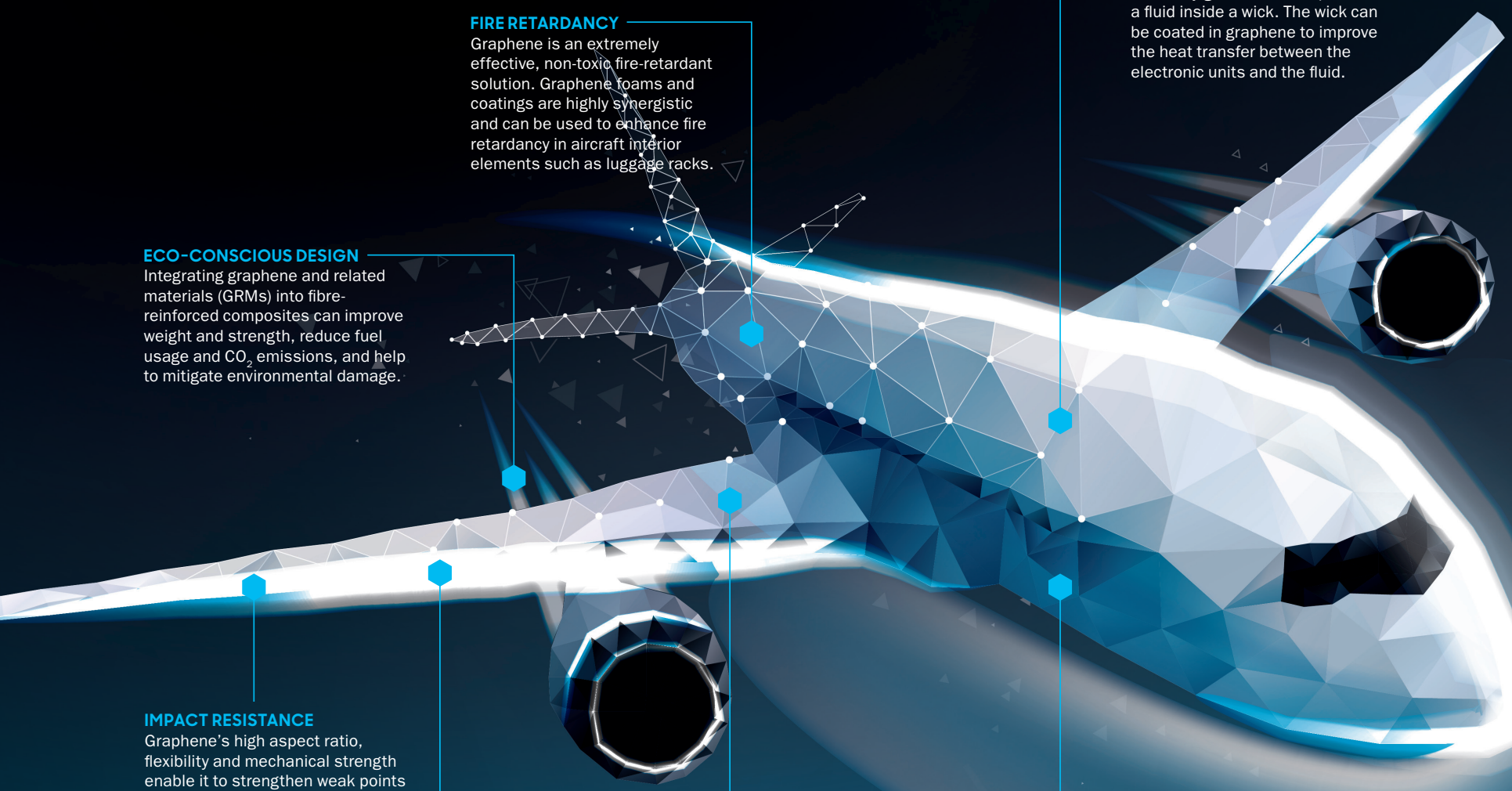
Graphene for Aviation

The Graphene Flagship is using breakthrough research and disruptive technologies to solve enduring challenges within the aviation industry.

THERMAL MANAGEMENT
Graphene can improve efficiency in heat transfer in loop heat pipes – cooling systems used in satellites and aerospace instruments. Loop heat pipes cool electronic devices by using the heat they generate to evaporate a fluid inside a wick. The wick can be coated in graphene to improve the heat transfer between the electronic units and the fluid.

FIRE RETARDANCY
Graphene is an extremely effective, non-toxic fire-retardant solution. Graphene foams and coatings are highly synergistic and can be used to enhance fire retardancy in aircraft interior elements such as luggage racks.

ECO-CONSCIOUS DESIGN
Integrating graphene and related materials (GRMs) into fibre-reinforced composites can improve weight and strength, reduce fuel usage and CO_2 emissions, and help to mitigate environmental damage.



IMPACT RESISTANCE
Graphene's high aspect ratio, flexibility and mechanical strength enable it to strengthen weak points in currently used composites. Aircraft wings coated with graphene-enhanced skin show levels of impact resistance of up to 60% higher than conventionally-skinned carbon fibre wings.

DE-ICING
Graphene-based electrical ice protection systems prevent the accumulation of ice on critical components of the aircraft. This enables the overall energy consumption of an aircraft to be reduced without compromising safety.

DAMPING VIBRATIONS
Graphene composite foams can dampen vibrations, reducing noise inside the cabin and improving mechanical properties and heath endurance.

AIR FILTRATION
Heatable foams made from low-density aerographene are used in cabin air filters to provide smart self-cleaning functions, reduce maintenance costs, and enable all air filter surfaces to be consistently and equally cleaned. Graphene air filters could even remove impurities more effectively than HEPA filters.

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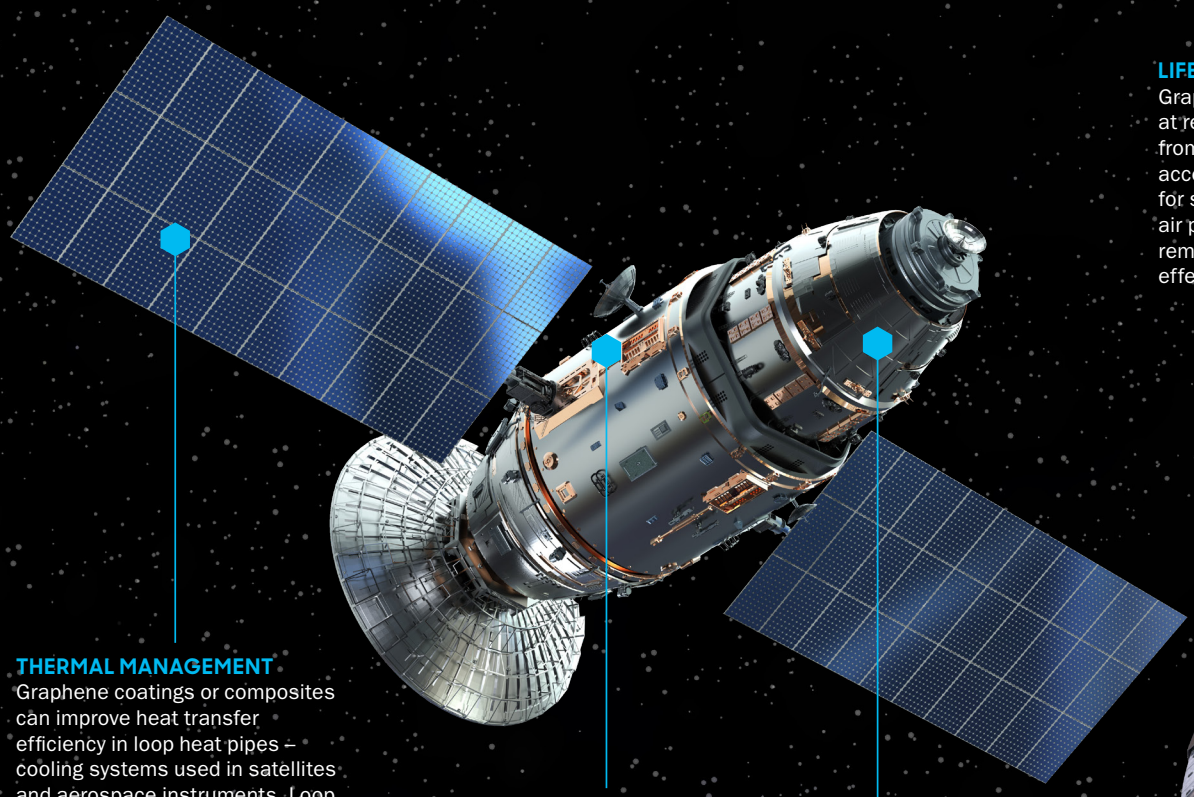
Graphene in Space

The Graphene Flagship is using breakthrough research and disruptive technologies to launch the next phase of space exploration.

SENSORS
Graphene's large surface-to-volume ratio, unique optical properties, excellent electrical and thermal conductivity, and high carrier mobility and density are beneficial for physical, chemical and bio sensing applications in space. Graphene-based sensors are smaller, lighter and more sensitive than traditional sensors.

RADIATION RESISTANCE
Space radiation is a significant hazard for astronauts. Graphene can absorb a significant amount of radiation in wavelengths from 300 to 2,500 nm, with a peak in the ultraviolet region. Besides this, 2D materials in general are promising coatings to absorb other types of radiation, which are harmful for astronauts in space.

LIFE SUPPORT SYSTEMS
Graphene is highly effective at removing contaminants from water, providing easy access to safe drinking water for safe explorers. Graphene air purification systems can remove impurities more effectively than HEPA filters.



THERMAL MANAGEMENT
Graphene coatings or composites can improve heat transfer efficiency in loop heat pipes – cooling systems used in satellites and aerospace instruments. Loop heat pipes cool electronic devices by using the heat they generate to evaporate a fluid inside a wick. The graphene coated wick enhances heat transfer between electronic units and the fluid.

DATA COMMUNICATION
Graphene-based integrated photonics can deliver high-speed optical networks that use less energy than networks based on current semiconductor photonics, while minimising costs and providing integration with existing technology. In addition, they can operate in extreme environments such as those found in space.

STRENGTH & IMPACT RESISTANCE
The high aspect ratio, large surface area and mechanical strength of graphene gives the potential to resist mechanical damage from micrometeoroids and debris, extending the lifetime of spacecraft. Graphene can also reduce gas permeation and leaking in composites, or add new electrical functionalities, to save space and reduce complexity of the spacecraft.

Funded by the European Union