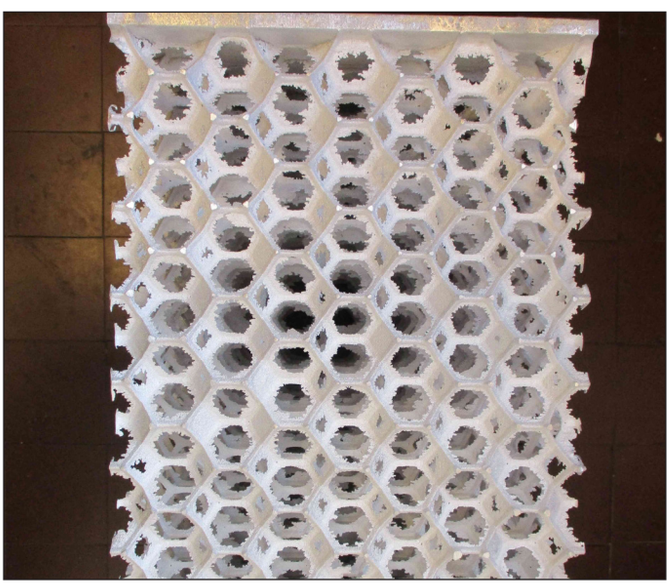
CNES

Aluminium foams released into the stratosphere

The French Space Agency (CNES) has entrusted Cetim with safely landing the 800 kg gondola of a stratospheric balloon and its cargo of scientific instruments.



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OUR CUSTOMER

Corporate name
CNES

Workforce
2,348 employees working in 4 centres in Paris, Toulouse and Kourou

Business activity
As a public industrial and commercial institution, the French Space Agency (CNES) has a budget of approximately 2.6 billion euros to implement France's space policy in 5 major strategic areas (Ariane, Science, Observation, Telecommunications, Defence). The CNES Balloon sub-directorate has been sending out balloons for over 60 years. These balloons are the only vehicles that can conduct long-term in situ study of the atmosphere at altitudes of up to 40 km.
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First Mars and its satellites, now the Earth's stratosphere!
The French Space Agency (CNES) has decided to equip the stratospheric balloons in the Strato-Science 2023 campaign with aluminium foam after this material was successfully used to protect a precious rover sent to the Mars moon Phobos. *"Unlike the honeycombed cardboard used for certain types of missions, aluminium foam is not sensitive to degassing, so there is no risk of distorting the measurements that will be taken"*, explained Mathieu Clavery, an engineer at CNES.
Initially, the calculations which were carried out on several different configurations (gondola weights, deceleration speeds, stresses, etc.) provided a means of estimating the porosity and elasticity of the foam to be used and thus defining the optimum cell diameter. Once the foam geometry had been validated, some data was set (gondola weight, foam porosity), resulting in new calculations for the production of a 300x300x400 mm foam block.

A comprehensive made-to-measure solution

A mould with vents as well as a lower and an upper screen to distribute the landing pressure, were then manufactured and used to cast the pure aluminium. *"In this case, we opted for casting rather than additive manufacturing due to lower production costs"*, disclosed Yves Gaillard, from Cetim.
The foams thus produced then underwent a number of tests (tensile, compression) in the laboratory. *"The real-life tests on the five parts produced were conclusive"*, stated Matthieu Clavery. *"The foam works in all directions and not just vertically, which provides superior protection. Cetim also designed an interfacing solution which makes it easier to fasten the foam to the gondola"*.
The successful validation, confirmed during a flight in Canada in August 2023, led to the commissioning of a second study, currently underway, for foams with the same cell geometry, but greater height.

Cetim's asset

Cetim has access to calculation tools developed over the years. Drawing on its multi-disciplinary knowledge (materials, thermics, fracture mechanics, etc.) it can fully control the variation between CAD and the end result.

Contact
Question & Answer Service
Tél. : +33 (0)9 70 82 16 80
sqr@cetim.fr
cetim.fr

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