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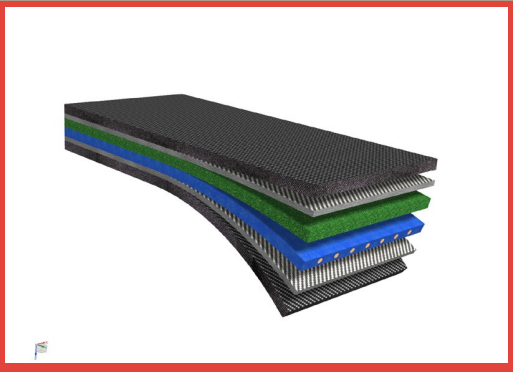

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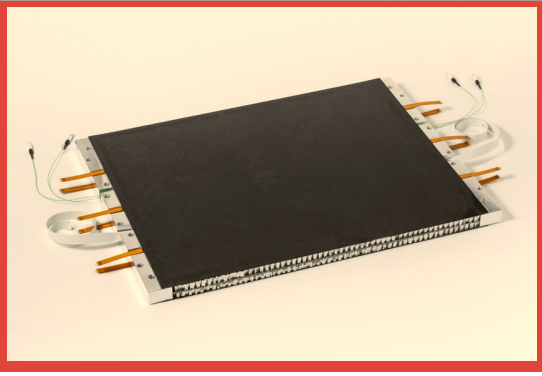

2

1 *multi-layer structure*
2 *multifunctional sandwich panel*

MULTIFUNCTIONAL DESIGN OF LIGHTWEIGHT STRUCTURES FOR SATELLITE APPLICATION

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Benefit compact

- Functional integration in carry-load structures -> minimized mass and installation space
- Integrative production process -> lower costs and times for satellite production and launch

Background

Conventional satellite design usually separates between structural and non-structural functions. The primary structure mainly supports mechanical loads and provides attachment points to the subsystems. These are developed and tested separately and integrated at the final stage of the assembly process. Such separation typically not only increases mass and installation volume but also times and costs for the production and launch of the spacecraft. Integrated multifunctional structures offer the possibility to eliminate these drawbacks.

Results and applications

By functional integration non-structural functions that are usually provided by stand-alone subsystems are integrated directly into the primary structure during production. Composite materials offer high lightweight potential and due to their multi-layer character they are suitable for functional integration: each layer can be defined and designed to provide one or more specific functions (figure 1). A multifunctional sandwich panel has been developed at Fraunhofer Institute LBF (figure 2). Piezoelectric actuators, flat cables and optical fibers have been successfully integrated to fulfil three non-structural functions: vibration reduction, energy and data transfer. The panel integrates moreover three additional functions by using suitable materials: heat transfer, radiation shielding and impact protection. This multifunctional concept opens up new opportunities for highly integrative and standardized satellite production processes.