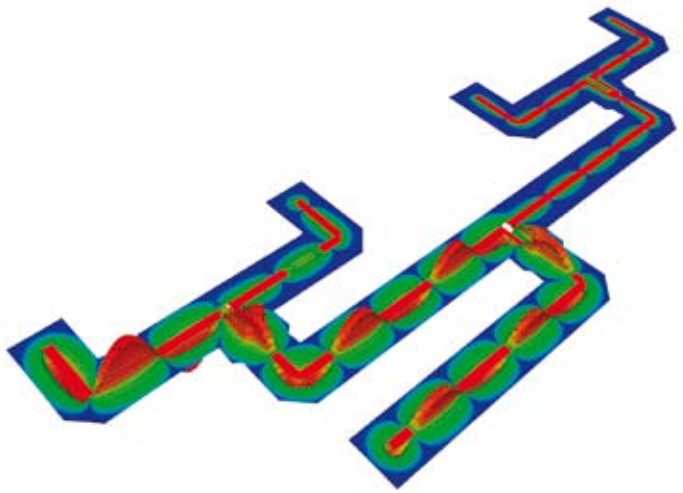
# Summary

Within the framework of the project VERSA, a new approach to beam forming networks is investigated. The aim is to combine structural and electrical functions in one multilayer to gain electrical performance and to save weight. For this purpose a library of standard components for the RF-designer is developed, as well as the fabrication technology to produce these modules reliably and with high yield.



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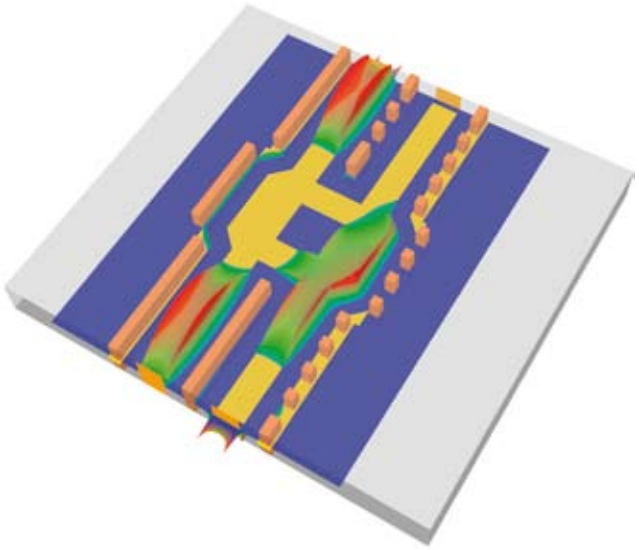
# VERSA

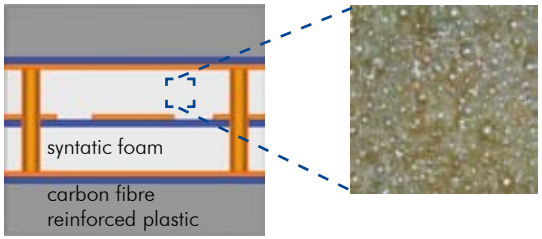
Power Distribution Networks
for Space Applications



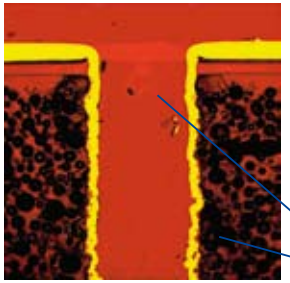
## Verteilnetzwerke für Satellitenanwendungen

Consortium

# Syntactic Foam Multilayer



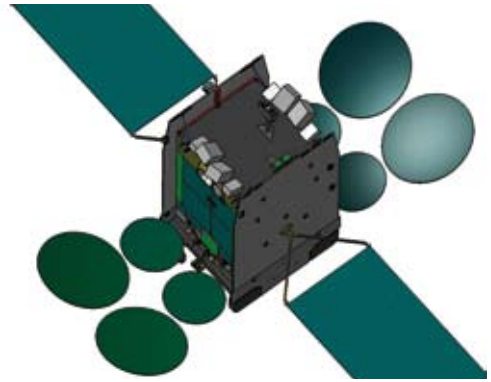

Beam forming networks like a Butler Matrix distribute micro-wave signals into a multitude of outputs. By distributing the signal also spatially, considerable line lengths are inevitable. Thus, low insertion loss and high phase stability are required for high performance. A dielectric with very low permittivity is likely to meet these requirements. Syntactic foam combines low permittivity with light weight, good compressive strength and space heritage. It is a composite, made up of hollow spherical glass fillers, which are embedded into a plastic matrix. Low losses combined with a dielectric constant around 1.4 make syntactic foam ideal for microwave uses.



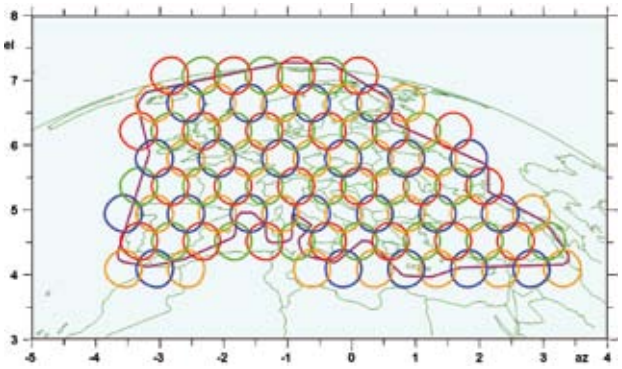

The plastic matrix of the intended syntactic foam fits into plating processes used for PCB manufacturing

**Cross-Section of Via Through Syntactic Foam Multilayer**

# Applications



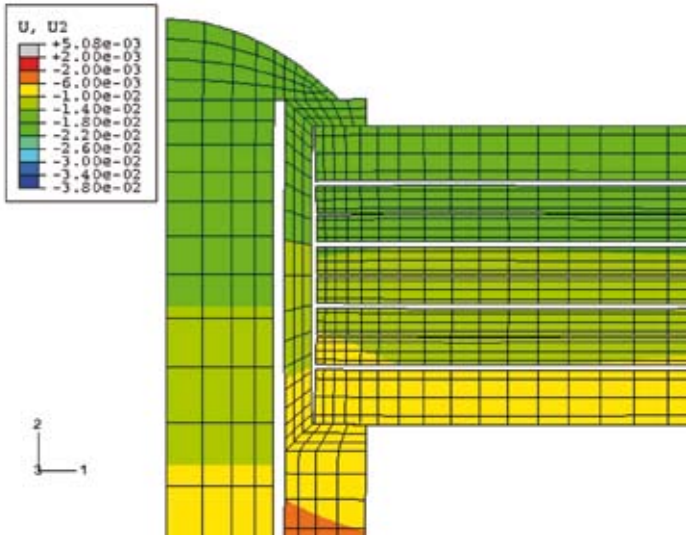
Electronically steerable antennas are an important part of reconfigurable broadband satellite communication systems. Their performance depends highly on precision beam forming networks. The new multilayer technology developed in VERSA will provide lightweight and mechanically stable circuits for beam forming networks and other RF-harness.



**Ka-Band Broadband Communication**

# Reliability

Beam forming networks in satellites are exposed to large temperature variations in orbit as well as to shock and vibration during launch. The composite of materials with different thermal expansion and very complex thermo-mechanical behaviour demands for very thorough analysis and simulation of the combination and its interfaces. It is thus very important to involve thermo-mechanical design aspects right from the beginning.




**Simulation of Thermo-Mechanical Stress on a Bushing Through the Multilayer**