

## 3D Multifunctional Ablative Thermal Protection System

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NASA is developing the Orion spacecraft to carry astronauts farther into the solar system than ever before, with human exploration of Mars as its ultimate goal. One of the technologies required to enable this advanced, Apollo-shaped capsule is a 3-dimensional quartz fiber composite for the vehicle's compression pad. During its mission, the compression pad serves first as a structural component and later as an ablative heat shield, partially consumed on Earth re-entry.

This presentation will summarize the development of a new 3D quartz cyanate ester composite material, 3-Dimensional Multifunctional Ablative Thermal Protection System (3D-MAT), designed to meet the mission requirements for the Orion compression pad. Manufacturing development, aerothermal (arc-jet) testing, structural performance, and the overall status of material development for the 2018 EM-1 flight test will be discussed.