

3D printed pipe segments with built-in heating and temperature sensing capabilities

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Topic: Additive Layer Design

Word Count: 210

Spacecraft thermal regulation is crucial to ensure survival, optimum operation and lifetime of onboard (sub-)systems and components by preventing overheating or freezing. To ensure optimum control and subsequent performances, thermal management systems such as fluid ones require temperature sensors and heating elements to be integrated at strategic locations. Nowadays, the integration of those elements involves constraints that limit efficiency.

In the framework of the EU project AHEAD led by CSEM, a pipe segment including 3D Printed built-in heating and temperature sensing elements was co-developed by CSEM (design, sensor Aerosol Jet Printing), LISI Aerospace Additive Manufacturing (LPBF) and Thales Alenia Space France (end-user requirement specifications, co-design, and validation testing).

Thanks to a built-in electrical connector and precisely machined terminations, this pipe segment is a one-part plug and play device that offers heating power up to 60W and temperature measurement from -65 to +90°C, without the need for integrating any element.

In ECSSMET, we intent to present the results and lessons learned from the design, manufacturing and testing of the prototypes. Tests include CT scanning, heater and sensor functional & performance tests, thermal lifetime testing, leak testing, proof/burst pressure test. We will also further elaborate on the key technology bricks involved in this use case and how those could serve other applications.

