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From Vision to Flight Hardware: Advanced Manufacturing and Materials for Europe's Space Ambitions

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ABSTRACT

Europe's space sector is entering a period of profound transformation, driven by growing commercial activity, increasing public investment, evolving security needs, and rising expectations for climate, digital, and industrial capabilities. As missions become more ambitious and technically demanding, advanced manufacturing is emerging as a strategic enabler of Europe's future space ambitions. No longer a supporting function, manufacturing now plays a central role in determining Europe's ability to develop spacecraft, launchers, instruments, and services that are competitive, sustainable, resilient, and autonomous.

Drawing on the strategic direction of ESA Strategy 2040 and the ESA 2040 Technology Vision, this presentation will show how advanced manufacturing can translate policy objectives into operational space capabilities. It will identify key research and development priorities across critical spacecraft and launcher functions, including structures, propulsion, thermal systems, communications, mechanisms, and optics, while also addressing enabling technologies such as additive manufacturing, composites, electronics, digitalisation, joining technologies, and in-space manufacturing.

To maximise impact, future R&D must address the entire innovation pathway, from concept development to qualification, industrialisation, and flight demonstration. By strengthening process maturity, repeatability, inspection, supply chain resilience, and industrial adoption, advanced manufacturing will help transform Europe's technological potential into reliable flight hardware and sustain its leadership in the global space sector.

Keywords: Advanced Manufacturing, Space Technology Innovation, Materials Development

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