

## ArianeGroup successfully tests first combustion chamber produced entirely by 3D printing

Lampoldshausen, 3.June 2020

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- **The success of these tests paves the way for rocket engines made entirely by additive manufacturing (3D printing)**
  - **The liquid propulsion teams at ArianeGroup in Germany designed and produced a completely 3D printed combustion chamber, under ESA's Future Launchers Preparatory Programme for the upper stage engines of future European launchers**
  - **The success of the hot firing tests, which took place from 26.May to 2.June on the test bench at the DLR German Aerospace Center in Lampoldshausen, represents another major milestone in the development of very low-cost high-performance liquid propulsion rocket engines**
  - **ArianeGroup is one of the world's leading specialists today in the application of 3D printing to high-performance equipment and engines involving metal parts of complex geometry subjected to extreme conditions of temperature and pressure.**
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The completely 3D-printed combustion chamber, designed by ArianeGroup in Germany, was successfully fire tested 14 times between 26.May and 2.June on the P8 test bench of the DLR German Aerospace Center's Lampoldshausen testing facility.

These tests were conducted jointly by ArianeGroup and DLR and follow on from the hot fire test campaign carried out last year, which validated 14 technological building blocks for future liquid propellant rocket engines. The results obtained represent a key step in the preparations for the future development of very-low-cost rocket engines.

This 3D-printed combustion chamber was manufactured and tested under ESA's Expander-Cycle Technology Integrated Demonstrator (ETID) project, part of ESA's Future Launchers Preparatory Programme. It is a full-scale demonstrator for a launcher upper stage engine. This demonstrator incorporates the very latest propulsion technologies and is designed to validate innovative manufacturing technologies, materials and processes, such as 3D printing (by laser fusion and projection), laser ignition, and the use of low-cost materials.

This combustion chamber features numerous innovations, such as the low-cost copper alloy cooling channels and an outer jacket made by "cold gas" spraying. Also, the combustion chamber includes a single-piece injection head produced by laser fusion 3D printing using all the injectors. This is an ideal solution for significantly reducing engines construction times and production costs in the future.

## Press release

3D printing will be adopted across the board going forward for all ArianeGroup liquid propellant engines, for both upper stage engines (ETID) and high-thrust main stage engines (Prometheus). The work on ETID and Prometheus is being carried out under ESA's Future Launchers Preparatory Program (FLPP). This program aims to enhance the competitiveness of future European launchers by creating mature technical solutions that are ready for rapid deployment, developing products with lower cost, effort, and risk.

These programs enable ArianeGroup – which manages the entire parts value chain from design to manufacturing – to develop its expertise in the field of 3D printing for launcher propulsion systems, a technology which is revolutionizing the design and production of future rocket engines.

ArianeGroup already uses 3D printing to manufacture many components for Ariane 6 engines. Apart from significantly reducing costs and shortening production cycles, the use of 3D printing has made it possible to integrate the Auxiliary Power Unit (APU) into Ariane 6, thus increasing the launcher's unrivalled ability to adapt to the needs of different missions.

ArianeGroup's key advantages are its machines of the highest standard at the company's Vernon(France) and Ottobrunn (Germany) sites, and the ability to draw on the expertise of local companies at the cutting edge of 3D printing, with the Normandy based Volum-e company, and in Germany, with AMCM in Starnberg and Impact Innovations in Rattenkirchen .

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### **About ArianeGroup**

**ENG:** ArianeGroup develops and supplies innovative and competitive solutions for civil and military space launchers, with expertise in all aspects of state-of-the-art propulsion technologies. ArianeGroup is lead contractor for Europe's Ariane 5 and Ariane 6 launcher families, responsible for both design and the entire production chain, up to and including marketing by its Arianespace subsidiary, as well as for the missiles of the French oceanic deterrent force. ArianeGroup and its subsidiaries enjoy a global reputation as specialists in the field of equipment and propulsion for space applications, while their expertise also benefits other industrial sectors. The group is a joint venture equally owned by Airbus and Safran, and employs approximately 9,000 highly qualified staff in France and Germany. Its 2019 revenues amounted to 3.1 billion euros.