

IAF SPACE PROPULSION SYMPOSIUM (C4)  
Liquid Propulsion (1) (1)

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DEVELOPMENT OF THE LIQUID OXYGEN AND METHANE M10 ROCKET ENGINE FOR THE  
VEGA-E UPPER STAGE

**Abstract**

In the frame of the VEGA-Evolution program aimed at increasing the competitiveness of VEGA launch

system, the European Space Agency ESA is developing with AVIO as prime contractor a new 10 Tons full expander cycle engine using liquid oxygen and methane as propellants, called M10. It is recalled that one of the main innovations of M10 is the large use of Additive Layer Manufacturing (ALM) for its main subsystems (Turbopumps, Thrust Chamber, Valves etc...) in order to meet the challenging recurring cost objectives and time to market. The present work outlines the development status of the M10 liquid rocket engine, currently in phase B2 focusing on the first engine development model DM1 hot firing test campaign. In particular, this activity has been conducted at the Space Propulsion Test Facility (SPTF), the AVIO test stand in Sardinia, in 2022 with a total of 20 successful firing tests and a cumulated overall firing time of 1200 seconds. In addition, as passenger objectives, cold flow tests have been performed to investigate and identify the best strategy to chill-down the engine lines prior the engine ignition in flight, in order to reduce time and propellants consumption.

From the know-how and experience acquired thanks to the successful DM1 experimental campaign, the second engine development model, DM2, is being integrated at AVIO premises and the relevant firing test campaign will be completed in 2023 at AVIO SPTF test stand. The M10 DM2 introduces several optimisations in the engine subsystems, including engine regulation and pneumatic valves in a full flight-like configuration. The planned DM2 engine tests will add another step to consolidate the development of the engine, looking for the best compromise among performances, recurring costs, reliability, and development risks.