

SPACE PROPULSION SYMPOSIUM (C4)
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THE ITALIAN LOX/LCH₄ ROCKET ENGINE TECHNOLOGY DEMONSTRATOR:
ACHIEVEMENTS AND OUTLOOK**Abstract**

The HYPROB program is carried out by CIRA under contract by the Italian Ministry of Research with the main objective to improve Italian technology capabilities on liquid rocket engines for future space applications, with specific regard to LOx/LCH₄ propulsion.

In such framework the BREAD project is carried out with the aim of designing, manufacturing and testing a LOx/LCH₄ ground demonstrator and associated breadboards for design verification.

The demonstrator high-level requirements can be summarized as follows: • Thrust class of 30 kN, relevant to future applications of space propulsion • Pressure-fed testing • Regenerative cooling with liquid methane representative of heat exchange processes of an expander cycle engine.

The 30 kN class of the demonstrator has been selected as the most appropriate to ensure scalability and representativeness of the test for future space applications, in order to take full advantage of previous experience of prototype research. The couple oxidizer fuel LOx/LCH₄ has been selected, coherently with national programmatic guidelines, in synergies with the developing Italian capability in Liquid Rocket Engines design and research.

In a long term perspective, such a propulsion technology may encompass a wide range of propulsion systems, from launcher main stages up to small thrusters, but present envisaged applications regard mostly: • upper stages of small launchers; • primary propulsion systems for interplanetary missions, such as ascent and landing modules.

That development approach has been selected in order to proceed step by step, from the understanding of the basic physical phenomena i.e. combustion and heat transfer, and then to validate design and analysis methodologies by simple breadboards, for risk mitigation purposes.

In this paper the more recent achievements will be highlighted, in particular for what concerns breadboards testing activities completed in 2014. Moreover, since the Critical Design Review has been successfully passed in 2014, the overview of the demonstrator components manufacturing and full-scale validation tests in Avio Fast₂ facility, such as injector head and igniter, will be described. An outlook of the ongoing activities will be also given.