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# H-IMP: A NEW PROPULSION TEST FACILITY FOR LOX/LCH4 LIQUID ROCKET ENGINES WITH ADVANCED OPTICS/LASER DIAGNOSTICS

**Abstract**

The H-IMP facility, located at the Italian Aerospace Research Centre (CIRA) in Capua (CE), is nearing completion and represents a significant milestone in the HYPROB Program. The activities described in the paper have been conducted in the framework of the HYPROB-New Program, carried out by the Italian Aerospace Research Centre (CIRA) and funded by the Italian Ministry of University and Research (MIUR) in order to improve the National background on rocket engine systems for space applications. The Program has the strategic objective to improve National system and technology capabilities in the field of liquid rocket engines for future Space Propulsion Systems applications, with specific regard to LOX/LCH4 technology. As a matter of fact, the acquisition of know-how in liquid rocket propulsion requires numerous test campaigns on technological demonstrators: one of the implementations of the HYPROB Program is the HYPROB-IMP project whose main purpose is to design and build a Propulsion Test Facility (H-IMP) allowing test activities on Liquid Rocket Engine. Specifically, the test bench within the facility will accommodate testing of small combustion chambers fueled by OX/CH4, in both liquid and gaseous phases, and optionally hybrid engines, capable of withstanding combustion chamber pressures up to 7 MPa (70 bar). The primary objective of H-IMP is to support the development of innovative propulsion systems through experimental testing, employing advanced optics/laser diagnostics. The H-IMP facility is expected to become operational from 2025. It will be equipped to conduct tests on gaseous and/or liquid demonstrators, at pressures up to 70 bar and flow rates reaching 1.5 kg/s of oxygen and 0.5 kg/s of methane, with test durations of up to 30 seconds. Additionally, the facility will include a demineralized water supply line to allow tests on engines with regenerative cooling, with flow rates up to 22 kg/s and pressures up to 100 bar. Within the full paper, some process diagrams will be shown, the operation of the facility will be briefly described, and some results of simulations carried out with the numerical modelling software EcosimPro will be shown for different operating conditions. This software makes it possible to perform an in-depth analysis of the fluidic system and the control system, in order to optimize its performance and reliability. Finally, some updates about the delivery and commitment of H-IMP facility will be given.