SPACE PROPULSION SYMPOSIUM (C4)
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CIRA LIQUID PROPULSION TEST FACILITIES: VISION AND ROADMAP

Abstract

Whether expendable or reusable, the use of LOx-LCH4, can be considered a key element for the development of future launchers. In particular, while preserving the performance, this technology aims to meet the needs in terms of take-off weight reduction, resulting in lower costs and reduced environmental impact. The development of skills in liquid rocket propulsion, particularly if based on hydrocarbons, can only pass through the acquisition of an independent testing capability that can mitigate the risks inherent in space flight. This capability has traditionally represented a significant portion of launch vehicle development time and cost. In this regard, following its mission, CIRA has been involved in several international projects concerning liquid propulsion and has planned to build facilities, characterized by adequate sizes and instrumentation, in order to test liquid rocket engines of different thrust classes. The new plant will provide a valuable contribution to the national system in terms of experimentation, integrating the existing facilities and thus encouraging a natural increase of opportunities in space propulsion for both research and industrial activities. According to CIRA Roadmap for the development of new testing facilities and infrastructures for space propulsion, the Integrated Facility for Space Propulsion (I2PS) will be composed of two different test cells named PLUS and IMP. PLUS test cell is designed to test, above all, upper stage engines with thrusts up to 100 kN. The cell is supplied by oxygen and methane, both in liquid and gaseous phase, and by a high-pressure N2O feeding system for hybrid engines tests. IMP test cell, instead, is devoted test articles representative of small combustion chambers, fed with oxygen and methane, both in liquid and gaseous phase. Those engines, with a limited number of injectors, are able to sustain chamber pressures up to 7 Mpa and achieve thrusts up to 6 kN. Furthermore, an N2O feeding line will allow testing activities on hybrid engine demonstrators. This research cell will be integrated with a diagnostic laboratory that, through the use of advanced optical diagnostic, will allow the correct experimental characterization and basic research activities on combustion.

The present paper gives an overview of CIRA development plan and vision on liquid propulsion test facilities along with the first achieved goals.