Chemical Propulsion System for a Versatile Lander Demonstrator Platform

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Within an Astrium self-funded Research and Technology project a technology platform was built for the maturation of key technologies required for future space exploration and landing system. The project named HOMER (HOver Manoeuvre) was used as a demonstrator to show capabilities required for soft landing and reactive space servicing vehicle. To fulfil both needs, an advanced powerful chemical propulsion system was required. In addition, the versatility of the system with respect to the envisioned applications imposes the need for different configurations of the same baseline platform (single thruster, multiple thrusters). HOMER has performed successfully its first ground free-flight in October 2012.

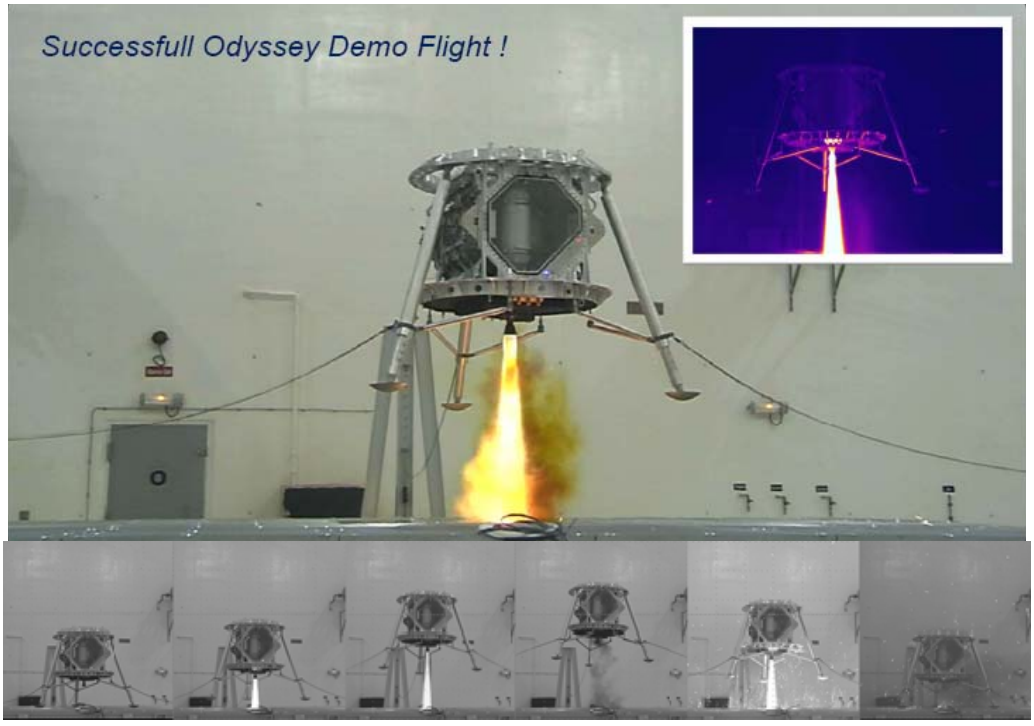
The key requirements for the propulsion system were a high reactivity and a very small centre of gravity shift. Combined with planning and cost constraints this has led, starting from scratch, to the following specific choices for the main propulsion system:

- A configuration with 4 piston propellant tanks in head to foot position,
- A pintle injector main thruster,
- A bang-bang valve for pressure regulation,
- A relatively high pressure range for a pressure fed system.

The propulsion system development logic encompassed a strongly integrated and concurrent engineering approach where design and analysis work was followed by manufacturing and verification to meet tight schedule and financial constraints. It was tailored to the specific constraints of an internally funded demonstrator program and therefore challenging, e.g. success oriented approach, tight schedule, competition with established programs for internal resources. For example, it was strived to minimise the number of tests and rely to a large extent on the use of simulations.

This success oriented simulation approach was possible thanks to a robust and flexible design. The use of large liquid orifices combined with a bang-bang pressure regulation approach has allowed to minimise pressure loss discrepancies and to achieve the desired thrust level and mixture ratio.

Goal of this paper is to present a short description of the HOMER vehicle, with a focus on the technical propulsion part of the vehicle and special attention for the simulations and the associated tests performed.


Successfull Odyssey Demo Flight !