

SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Poster session (2D)

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THE PESCHA SIMULATION CHAMBER: VACUUM AND DUST TRIBOLOGY TESTING  
MIMICKING PLANETARY SURFACE ENVIRONMENT CONDITIONS**Abstract**

The environment on the surface of the planets and minor bodies of the solar system presents several hazards for exploration missions. In particular, the environment characterized by vacuum/low pressure, dust and/or regolith, thermal cycles and radiations is critical for the crew and the space systems during planetary missions. The investigation and testing of the interaction of the planetary environment with the space systems are strongly required and recommended for the success of future exploration missions.

Thales Alenia Space - Italia, in the frame of the STEPS project - co-funded by Regione Piemonte (Project co-financed by EC Platform: POR FESR – 007/2013) is strongly involved in the development of new technologies for future space exploration missions. In the framework of these research activities the facility PESCha (Planetary Environmental Simulation Chamber) has been designed and manufactured. This new facility offers the possibility to perform thermal-vacuum tests in presence of lunar or martian soil simulants with the following characteristics:

- o Minimum pressure level approx  $10^{-6}$  mbar (without dust in the chamber)
- o Pressure regulation to operate with a partial pressure of CO<sub>2</sub> (or other gases) to mimic – for instance – Mars atmosphere.
- o Low Leakage rate (approx  $10^{-4}$  mbar l s<sup>-1</sup>)
- o Internal testing volume
- o 1100 mm diameter
- o 1200 mm length

The facility is also equipped with an internal chamber that limits the outflow of dust during tests with the displacement of large quantities of dust. The vacuum in the chamber is produced by the combined effect of an oil and a turbomolecular pump, separated from the main chamber by a secondary baffle trap chamber to block the dust transport avoiding damages to the pumping system. Two IR lamps are used to heat the main chamber and a supplementary IR lamp is used for heating the internal chamber.

Using the PESCha facility, tests to assess the behavior of a synchronous three-phase direct drive motor for an integrated system for mobility on planetary surface are scheduled for April 2012. The goal of the experiments is to verify the motor performances in vacuum and in a vacuum dusty environment reproduced using lunar regolith simulants developed in the frame of the STEPS project. Future tests envisaged at the PESCha facility will focus on the deployment of inflatable structures and on the behavior of the composing materials in vacuum.