IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 1) (4A)

Author: Prof. Michèle Lavagna
Politecnico di Milano, Italy, michelle.lavagna@polimi.it

Dr. John Robert Brucato
INAF - Astrophysical Observatory of Arcetri, Italy, jbrucato@arcetri.astro.it
Mr. Jacopo Prinetto
Politecnico di Milano, Italy, jacopo.prineto@mail.polimi.it
Dr. Giovanni Zanotti
Politecnico di Milano, Italy, giovanni.zanotti@polimi.it
Mr. Enrico Belloni
Politecnico di Milano, Italy, enrico.belloni@polimi.it
Dr. Fabrizio Fiore
INAF - Istituto Nazionale di AstroFisica, Italy, fabrizio.fiore@inaf.it
Mr. Daniele Gottini
Università degli Studi diFirenze (UniFI), Italy, daniele.gottini@unifi.it
Dr. Andrea Meneghin
Italy, andrea.meneghin@inaf.it
Mr. Vincenzo Della Corte
INAF-IAPS, Italy, vincenzo.dellacorte@inaf.it
Dr. Alberto Fedele
ASI - Italian Space Agency, Italy, alberto.fedele@asi.it
Dr. Silvia Natalucci
ASI - Italian Space Agency, Italy, silvia.natalucci@asi.it
Dr. Marilena Amoroso
ASI - Italian Space Agency, Italy, marilena.amoroso@est.asi.it

DEIMOS MOON INVESTIGATION THROUGH REMOTE AND IN SITU SCIENCE: THE TASTE MISSION

Abstract

Deimos and Phobos are considered primary targets of investigation to understand the origin and evolution of Mars and more in general the terrestrial planets of the Solar System. While there is no clear consensus on a definitive scenario for the moon's formation, two major hypotheses are considered among the scientific community: giant impact origin or asteroid capture. To unveil the origin and evolution of Phobos and Deimos, in the context of international exploration of the Mars system, it is necessary to have detailed knowledge of both moons. To date, no spacecraft mission explored either Phobos or Deimos as a primary objective: the JAXA Martian Moons Exploration (MMX) mission is planned to be launched in September 2024, targeted at Phobos. The Italian Space Agency financed TASTE mission is part of the ALCOR program and focuses on Deimos combining both global observations from a close orbit and on surface analysis with a lander equipped with a soil sampling tool. TASTE - Terrain Analyzer and Sample Tester Explorer – currently in phase A, is conceived as a CubeSat in CubeSat: 12U satellite, 3U of which are dedicated to a ballistic lander. The orbiter embarks a X-gamma ray spectrometer for chemical

abundance prospecting, and a VIS camera for moon mapping: the former is a customized miniaturized payload currently at TRL 6; the latter is a miniaturized TRL9 COTS, even recently tested in deep space. The lander, which clusters innovative solutions, is equipped with a small compact, stand alone integrated innovative sampling tool which minimizes the sample handling from soil to analysis chamber. The sampler is supposed to penetrate the soil a few centimetres depth to collect and directly deliver specimen into the sealed experimental chamber where a lab-on-chip is installed. That is the core of the on-surface astrobiology experiments which leans on immunoassay techniques exploiting chemiluminescence detection. The paper will report about this challenging mission design: from the mission analysis definition and low-thrust control synthetized, to the robust lander release to limit bouncing at contact, to the operational orbit selection and maintenance under the multi gravitational Martian system dynamics, to the most critical on board components selection and performance assessment towards feasibility for the two TASTE vehicles. The state of development for the lander soil sampling payload is also reported with breadboarding activities status to consolidate the design towards implementation.