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Future lunar exploration activities in ESA

B. Houdou, J.D. Carpenter, R. Fisackerly, D. Koschny, A. Pradier, S. Di Pippo, and B. Gardini
ESA-ESTEC, Keplerlaan 1, 2201 AZ, Noordwijk (James.Carpenter@esa.int)

Introduction

Recent years have seen a resurgence of interest in the Moon and various recent and coming orbital missions including Smart-1, Kaguya, Chandrayaan-1and Lunar Reconnaissance Orbiter are advancing our understanding. In 2004 the US announced a new Vision for Space Exploration [1], whose objectives are focused towards human missions to the Moon and Mars. The European Space Agency has established similar objectives for Europe, described in [2] and approved at the ESA ministerial council (2009). There is considerable potential for international cooperation in these activities, as formulated in the recently agreed Global Exploration Strategy [3].
Present lunar exploration activities at ESA emphasise the development of European technologies and capabilities, to enable European participation in future international human exploration of the Moon. A major element in this contribution has been identified as a large lunar cargo lander, which would fulfill an ATV-like function, providing logistical support to human activities on the Moon, extending the duration of sorties and the capabilities of human explorers.
To meet this ultimate goal, ESA is currently considering various possible development approaches, involving lunar landers of different sizes.

Lunar Lander Mission Options

A high capacity cargo lander able to deliver consumables, equipment and small infrastructure, in both sortie and outpost mission scenarios, would use a full Ariane 5 launch and is foreseen in the 2020-2025 timeframe.
ESA is also considering an intermediate, smaller-scale mission beforehand, to mature the necessary landing technologies, to demonstrate human-related capabilities in preparation of human presence on the Moon and in general to gain experience in landing and operating on the lunar surface.
Within this frame, ESA is currently leading several feasibility studies of a small lunar lander mission, also called “MoonNEXT”. This mission is foreseen to be to be launched from Kourou with a Soyuz in the 2015-2018 timeframe. The mission would be a first step to-wards mastering the automated precision landing with hazard avoidance required for a future cargo lander and essential for landing at the South Pole Aitken basin (SPA), the provisional MoonNEXT landing site. In addition the mission carries a strawman payload with several technology demonstration and testing packages, which will investigate advanced fuel cell and life sup-port technologies.
A small MoonNEXT-like lander (Soyuz-launched) constitutes one of several possible mission types for a first landing on the Moon. The coming year will see additional investigations into other possibilities, including a medium-size lander, launched in a shared Ariane 5 configuration, which could provide a better level of validation of the landing technologies with respect to the targeted large lunar lander, as well as a more significant payload mass.
Ultimately, the candidate intermediate mission options will be traded off to find the best balance of cost, mission implementation timeframe, development effort and representability. The reference intermediate lunar lander mission will be established so as to proceed with industrial Phase B1 activities in late 2009.
It is also planned to study the large lunar lander based on a full Ariane 5 launch, in order to elaborate the design and to enter in more detailed discussion with the international partners.

Possible Payload Packages: Multiple domains can be covered, depending also on the available pay-load mass (thus on the lander size):
• Environmental characterization and monitoring: radiation, dust, micrometeorite impacts, temperature etc. (medium TRL)

• Technology experiments for exploration preparation: e.g. life support and life sciences, small-scale or subsystem for ISRU, fuel cell etc. (low TRL)
• Mobility
• Payload transportation and manipulation
• Logistics: infrastructure, equipment, consumables etc.

The primary objective of any European Moon lander will be to enhance European capabilities for human exploration. It is expected that there will be provision for a significant inclusion of scientific interests.

References:

[1] National Aeronautics and Space Administration (NASA), The Vision for Space Exploration, NP-2004-01-334-HQ, NASA, Washington D.C, (2004).
[2] ESA declaration on Transporation and Human Exploration (2008).
[3] The Global Exploration Strategy, available at http://www.esa.int/SPECIALS/Space_Exploration_Strategy/SEMDAM0YUFF_0.h