

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

Author: Ms. Mariella Graziano
GMV Aerospace & Defence SAU, Spain, magg@gmv.com

Mr. Fernando Gandía
G.M.V. Space and Defence, S.A., Spain, fgandia@gmv.com
Mr. Aron Kisdi
GMV Innovating Solutions, United Kingdom, akisdi@gmv.com

HAEC LUNA: HUMAN ACTUATION AND EXPLORATION CIRCLE

Abstract

A new era has clearly started for Space Exploration, being the final goal the long term human presence in space. As such it is mandatory to settle from the very beginning clear strategic and technical plans/paths allowing humans to pursue fixed objectives in cost/time efficient manner while maximizing results and minimising environmental effects. Potential mission concepts shall be innovative but at same time sustainable, shall foresee a short term robotic-only based exploration and utilization while preparing/attempting for long term exploration and utilization, shall be attractive not only for institutional actors, but also for commercial/private organisations, shall be such to generate space for private and institutional international collaborations.

This paper intends to depict an overall approach to a sustainable approach to space exploration taking the Moon as study case, but thinking already to Mars.

The Moon is clearly the first obliged steps for the long-term/permanent presence of human on planetary surfaces. Getting humans back to the moon to stay will require the exploitation of lunar resources the most important, being, in the short-term, the water ice, which is known to be abundant on the bases of permanently shadowed polar craters. Nevertheless, and in order to guarantee a safe and sustainable habitability of the moon "surface" the following aspects shall be covered:

- Environment characterization, firstly in terms of water-ice availability/accessibility, radiation and dust effects on biological entities (astronauts, plants), and temperature ranges; secondary obtainability of useful material for in-situ energy production and storage (power, propellant, etc.) and infrastructures settling (i.e. regoliths utilization).

- Safe human habitability. Lava tubes might be useful as locations for lunar bases/colonies. The interiors of lunar lava tubes could potentially protect astronauts from the harsh effects of the lunar environment such as radiation and cosmic rays, meteorite impacts, and the extreme temperature differences between the lunar day and night. Last but not least, in case of permanent lunar colonies, lava tubes can protect moon explorers from rocket engines sandblasting from the at landing or departing probes.

- In situ manufacturing and resources utilization (ISRU), as well as waste limitation and recycling. Last but not least, and left to the long-term plans, in situ food production.

As first step, and in order to draw a sustainable strategy, an effort shall be devoted in analysing with details, and from the very beginning, what we will define the "Human Actuation and Exploration Circle (HAEC)". The HEAC, whose dimensions shall realistically not be larger than 100km diameter, shall as minimum contemplate the following fix elements: a landing site, a human habitability sector, scientific interesting regions and ISRU devoted area/s.

The target of this approach is to define an overall approach where technical needs, institutional ambitions, international collaboration requirements, commercial interests, legal framework and environmental sustainability might coexist and find the proper space.