Farside Explorer: Unique Science from a mission to the Farside of the Moon

David Mimoun[1] Mark Wieczorek [2]* and the Farside Explorer team[3]

([1]Université de Toulouse, ISAE/SUPAERO 10, avenue Edouard Belin, 31400 TOULOUSE mimoun@isae.fr, [2]Institut de Physique du Globe de Paris (* Mission proposer) , France, [3] Team members: full list available at http://farside.spacecampus-paris.eu/)

Farside Explorer is a proposed Cosmic Vision medium-size mission to the farside of the Moon consisting of two landers and an instrumented relay satellite. The farside of the Moon is a unique scientific platform in that it is shielded from terrestrial radio-frequency interference, it recorded the primary differentiation and evolution of the Moon, and it lacks Earthshine and can be continuously monitored from the Earth-Moon L2 Lagrange point. The primary scientific objectives of the Farside Explorer mission are to make the first radio-astronomy measurements from the most radio-quiet region of near-Earth space, to determine the internal structure and thermal evolution of the Moon, from crust to core, and to quantify impact hazards in near-Earth space by the measurement of impact flashes.

The Farside Explorer flight system includes two identical solar-powered landers and a science/telecom relay satellite to be placed in a halo orbit about the Earth-Moon L2 Lagrange point. One lander would explore the largest and oldest recognized impact basin in the solar system—the South Pole-Aitken basin—and the other would investigate the primordial highlands crust. Radio astronomy and geophysical instruments would be deployed on the surface, and the relay satellite would continuously monitor the surface for impact events

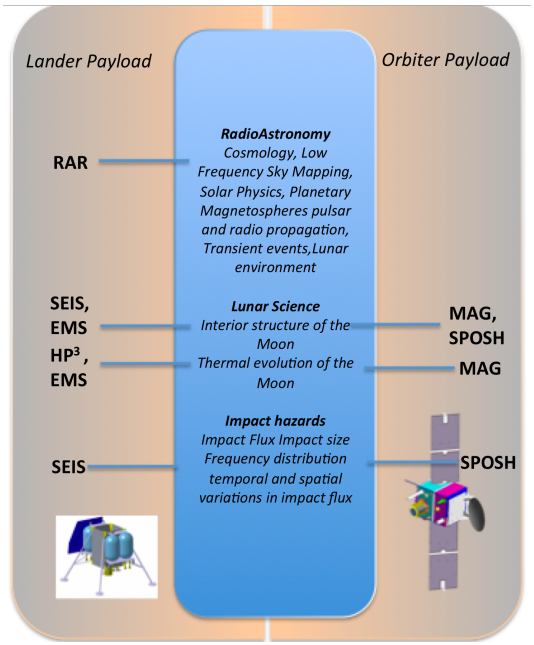

Figure 1 : Science Payload

As a direct consequence of the scientific requirements, the proposed space segment includes two spacecraft to land on the farside of the Moon, an instrumented relay satellite, and the launcher (either a Soyuz or Ariane 5 shared commercial launch).

The proposed mission concept is innovative by using a halo orbit about the Earth-Moon L2 Lagrange point (LL2) to provide a relay to the farside landers while simultaneously enabling the impact flash monitoring program.

The proposed ballistic trajectory starts from GTO to go to the Earth L1 and uses the instability of the manifold next to EL1 to return to the vicinity of the Moon. At lunar arrival, the intersection of the manifolds of the Earth-Sun and Earth-Moon system allows for the insertion, at a very low ΔV, of the mission elements into an Earth-Moon LL2 halo orbit.

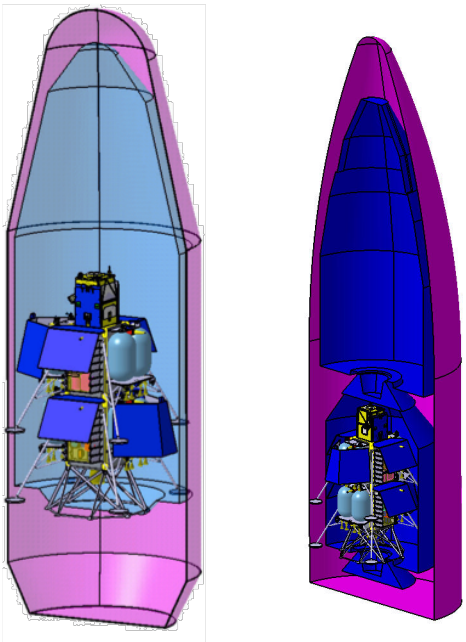

Figure 2 : Spacecraft Composite under Launcher fairing (courtesy Astrium)

The flight system uses the heritage of the Moonnext study. It is composed of two identical solar-powered landers and a science/telecom relay satellite in an LL2 halo orbit. It uses an ATV like thruster used for transfer and landing braking; bi-propellant hydrazine system provides attitude control, final descent, and landing. Continuous science operations are allowed by either RHUs or specific thermal design, based on parabolic reflectors. It has a dry mass of about 380 kg a wet mass: 1185 kg. The payload mass is 26 kg when the payload power is 200 W (day), 4 W (night).

The LL2 relay satellite is based on a small-satellite bus with a wet mass of about 150 kg, including a 50 kg payload (mainly the telecom relay).

Mission was foreseen to last four years, with an early launch around 2019-2020, to overlap other geophysical missions, and therefore provide a geophysical network.

The Farside Explorer is supported by the radio astronomy and lunar science communities. This consortium represents 7 international Lunar Science Institutes and about 500 individuals.