**Cis-lunar Transfer Vehicle (CLTV): a versatile vehicle to support future exploration missions**

G. Cifani*1\*.*

*1ESA-ESTEC, Noordwijk, The Netherlands, Giorgio.cifani@esa.int*

**Abstract**

Following the efforts of the ATV (Autonomous Transfer Vehicle) development, Europe acquired the capability of autonomously operating space transportation system, while opening up possibilities for its participation in the setting up and the maintenance of an orbital infrastructure for human spaceflight.

The next step in human spaceflight is a global initiative for human exploration of the Moon, based on the development of the Gateway staging post, as an intermediate step towards deep space travel.

The Gateway, placed in a Near Rectilinear Halo Orbit (NRHO), would be hosting crews on their way to the Moon surface; also it would serve as an assembly point for the various elements of lunar landers, safe haven in case of contingency situations and, potentially, as a propellant depot. Unlike lower lunar orbits, the NRHO allows in principle to access any landing site on the Moon. It is also accessible from Earth via low delta-v transfers, so launch service providers can choose propellant-optimised staging strategies.

Within this international framework, Europe could provide the Gateway with complementary deep space transportation functions, needed for sustainable exploration. In particular, the study of a multi-user capability vehicle, named the Cis-lunar Transfer Vehicle (CLTV), for un-crewed missions to the Moon’s vicinity, but compatible with crew presence, could become a strategic capability to support sustainable human lunar exploration starting in 2026-2027. Moreover, CLTV development could be exploited on further applications such as missions to a post-ISS orbital infrastructure in LEO and missions enhancing European autonomy.

CLTV development will enter into Phase A/B1 in 2020 and this paper addresses the approach and challenges faced during its feasibility study.