

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
New missions enabled by Extra-large launchers (8)

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PRELIMINARY CONCEPT OF A REUSABLE CIS-LUNAR CREW TRANSPORTATION SYSTEM

Abstract

In the frame of the Third International Master SEEDS Project Work focused on a permanent habitable space station located in the Earth-Moon Lagrangian Point 1 (EML1) called EOS, the concept of a dedicated crew transportation system has been developed.

The long-term exploration scenario, which is envisaged in the time frame of 30 years from now, features an advanced phase of Moon surface exploration, with a permanent base and in-situ resource utilization, the availability of launchers with sustained lifting capabilities (crew/cargo), and an established exploration program (human/robotic) towards the Moon, Mars and beyond.

Sitting on the edge of the Earth-Moon gravity well, EOS would act as the local space transportation hub. Mission towards solar-system destinations would be assembled, maintained, refueled at EOS.

The envisaged Crew Transportation System is composed by two different re-entry vehicles enabling crew transfer between Earth and EOS. A 10-astronaut Cis-Lunar Orbiting Shuttle (CLOS) accounts for the nominal traffic resulting from EOS crew rotation needs, and astronauts in transit for the Moon Base and Mars. A Rescue re-Entry Boat (REB), providing accommodation for up to 6 astronauts is in charge of crew return from EOS to Earth in case of medical contingencies, EOS major failures requiring total evacuation, and manned Mars mission return.

Different concepts are traded exploring the impact on launcher capabilities, system reusability, landing site options, and issues related to return to Earth of injured or ill crew members. Both vehicles are tailored for a Moon-to-Earth re-entry and feature a flattened biconic shape and skip re-entry as nominal trajectory.

A preliminary design with budgets is performed for the CLOS. Opportunities to exploit CLOS design features at system and subsystem level for the REB design are identified. Critical technologies required for the development of a high frequency, reusable, manned cis-lunar transportation system are pointed out. In particular, the feasibility of the system results to be strictly connected with the availability of a man-rated launcher in the class of 90 tons to LEO.