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From Earth Missions to Deep Space Exploration (05)
Cis-Lunar Outposts and other Exploration Missions (5)

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ESA NEAR EARTH EXPLORATION MINIMUM SYSTEM (NEMS) STUDIES

Abstract

The NEMS – Near-Earth Exploration Minimum System – internal study was conducted at ESA's Concurrent Design Facility (CDF) at ESTEC, The Netherlands, between March and April 2011. The study was carried out by an interdisciplinary team participating in eight design sessions, and it was aimed at the identification of the main trade-offs, system drivers and critical risk areas associated with basic human exploration missions beyond the Earth-Moon system. The study intentionally considered simple mission assumptions in the lower end of such mission class – hence the name of the study. The mission scenario is entirely theoretical, still it provides a concrete frame that can be applied to the analysis of the generic science and technology aspects involved in the design of such missions. The particular mission goal is to transfer a crew of three astronauts from the Earth to an accessible Near-Earth Asteroid (NEA), and to return them safely to Earth before 2030. Two case studies were analysed: a relatively short mission (150 days) dubbed "Weekend Escape" and a long-duration (300 day) one called "Summer Holidays". As an initial assumption the study focused on the transportation aspects and it did not consider any surface operations.

The study, which was funded by ESA's General Studies Programme (GSP) within the Future and Strategic Studies Office, has been used as a basic system scenario to help identify auxiliary studies in areas where progress can be made in addressing uncertainties, risks and knowledge gaps, regardless of the specific exploration targets and mission scenarios ultimately being considered by ESA and its international partners. Follow-up industrial studies are now being implemented by ESA addressing e.g. knowledge on environmental issues (radiation and crew operations, micrometeorites, "dusty plasma") that are important in the context of crewed missions to asteroids, planetary moons or surfaces. Other studies are investigating how technology can cope with the physical physical constraints. For instance, any interplanetary mission must first leave the Earth's gravity well; thus, industrial studies will investigate mature options for Earth departure propulsion stages. Other studies will address necessary trade-offs, such as e.g. on crew size, mission duration and life support technologies. In addition of providing information, models and design guidelines for future projects, the study has also enabled to assess the overall mission architecture and estimate system budgets, in that way complementing previous ESA assessment on other potential exploration missionS to the Moon and Mars.