

Using the ISS to Prepare for Exploration (01)
ISS as the Foundation for Exploration (1)

Author: Mr. Hiroshi Ueno
JAXA, Japan, ueno.hiroshi@jaxa.jp

MISSION CONCEPT STUDY OF TECHNOLOGY DEMONSTRATION FOR HUMAN SPACE
EXPLORATION

Abstract

The Global Exploration Roadmap (GER) has been released by International Space Exploration Coordination Group in September 2011 to reflect the international effort to define feasible and sustainable exploration pathways to the Moon, nearEarth asteroids, and Mars. Beginning with the International Space Station (ISS), this first iteration of the roadmap examines possible pathways in the next 25 years.

The most of the key technologies to implement the Design Reference Missions (DRMs) in the exploration pathways should be demonstrated before the actual use of the human flight and operation. The technology demonstration are expected at the ground testbed (Analog Sites on the earth, etc.), ISS and Robotic Precursor to Moon, Asteroid or Mars. In addition to these locations, Exploration Test Module (ETM) beyond the ISS capabilities are identified at the candidate location for the demonstration in GER.

This paper focuses on the mission concept to fully utilize ETM. ETM demonstration should be the integrated mission to demonstrate the total risk reduction for future human mission. Utilizing ISS capabilities to assembly, test, and reconfiguration/reutilization of modules/equipments/parts are also important features for ETM. ETM Mission should demonstrate technologies which need different orbital conditions from ISS such that the radiation and micrometeorite environment, external thermal conditions are similar to the exploration environment. The Rendez-Vous and Docking (RVD) in deep space environment (w/o GPS, etc) and thermal management (w/o earth albedo and ISS) are also the different from ones in ISS environment. The demonstrate technologies that are difficult to be demonstrated at ISS or ground testbed should be candidates for ETM mission such as propulsion technologies, entry, descent and landing. The demonstration technologies which need large scale model and not optimal for robotics precursor should be also included in ETM.

The mission scenario for ETM could be started from Human Tended Module (HTM) and folded Solar Electrical Propulsion (SEP) docked with ISS for checkout. The unmanned HTM and the deployed SEP will be departed from ISS to EML(Earth Moon Lagrangian Point, TBD) for SEP orbital transfer test. HTM is be habitation modules equipped with radiation and micrometeorite protection, rendezvous/docking and thermal radiator to test them at EML for long duration. The human vehicle (possibly unmanned) with the cryopropulsion in space (CPS) will visit HTM at EML for CPS test and RVD test. The human vehicle will undock with HTM and return to earth for highspeed reentry and heat protection test.