

SPACE PROPULSION SYMPOSIUM (C4)
Missions Enabled by new Propulsion Technology and Systems (6)

Author: Mr. Yuichiro Nogawa
Earth-Track Corporation, Japan, nogawa.yuichiro@jaxa.jp

Prof. Hirokazu Tahara
Osaka Institute of Technology, Japan, tahara@med.oit.ac.jp
Mr. Akira Tsuchida
Earth-Track Corporation, Japan, akira.tsuchida@earth-track.com

CREW WASTE WATER ELECTRIC PROPULSION SYSTEM DEVELOPMENT PLAN

Abstract

Electric propulsion system is well known as its more efficient Isp than that of chemical propulsion system but its thrust is lower. As a result, it is so popular with small satellite systems but there is little relationship with manned spacecraft. The manned spacecraft's propulsion system mostly uses chemical propulsion to produce high thrust for rapid acceleration. Like ISS, if manned propulsion system needs to be refueled, re-supply ships shall be launched repeatedly and the cost is increasing. Considering the future deep space manned mission, it is difficult to supply fuels many times or gain enough fuels emergency thruster usage (e.g.: emergency return or loss of attitude control) and new "reusable, ecological, green" propulsion system to resolve this difficulty is significantly important for that kind of mission. Earth-Track Corporation and Osaka Institute of Technology have started the making a strategy of new advanced electric propulsion system by using "waste water" produced in a spacecraft. Our basic concept for this new advanced electric propulsion system is that modification with existing electric propulsion system by changing its fuel. As mentioned above, we need to change popular fuel (e.g. Xenon) to "water". We are considering two options: one is DC Arcjet as a kind of electro-thermal propulsion, the other is Ion Engine produced by micro wave energy as a kind of electrostatic propulsion. Regarding "water" as a propellant, we are planning to use the wasted water in ISS currently on orbit. After water is consumed by ISS crew members through drinking and cleaning activities, WRS (Water Recovery System) provides clean water by reclaiming waste water, including water from ISS crew member's urine, cabin humidity condensate, and extra vehicular activity (EVA) wastes. We also have a plan of developing small satellite using this new propulsion system. To use the waste water of ISS, we can use HTV (H-II transfer Vehicle) to deliver the small satellite placing on the exposed pallet of HTV. Once HTV is berthed to ISS, it can be transferred to JEF (JEM Exposed Facility) by ISS robotic arm. After Combining the propellant "water" tank module (released via JEM Airlock) with original satellite module that is launched in JEF, the "completed" satellite goes to the moon or beyond. We aim the first small satellite produced by a private company and an institute to reach the moon in the world, using this water electric propulsion system.