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Author: Ms. Yukta Sharma
India

Mr. Chesler Thomas
Space Generation Advisory Council (SGAC), India
Mr. Naga Bharath Daka
India
Mr. Manan Malik
University of Petroleum and Energy Studies, India

INTUITIVE ASTRONAUT MANEUVERING UNIT FOR EXTRA VEHICULAR MISSIONS

Abstract

Reaching beyond the sky has always been the inspiration for all space efforts, but the first experience of triumph was felt by the Astronauts aboard the Gemini 4, where the Hand-Held Maneuvering Unit (HHMU) provided mobility and freedom to perform a plethora of operations in microgravity. SAFER, a smaller backpack propulsion system intended as a safety device during spacewalks is currently the state-of-the-art manned maneuvering system used aboard the ISS.

Essentially a backpack with fuel tank, cold gas thrusters, control system and harnesses using Nitrogen gas, there is high scope for frugal innovation in this technology. This student-driven project utilizes the latest technologies to augment the Maneuvering Unit as it is paramount to the success of Moon, Mars Venus or even the Earth Orbit colonization strategies pursued by space agencies and companies worldwide.

The designed and simulated Maneuvering Unit successfully utilizes cold gas thrusters augmented with electric heating to function as resistojet, in an ergonomic backpack design utilizing all-composite body and metallic tankage for gas storage, to provide higher thrust and efficiency, and utilizes a unitary thruster architecture to incrementally provide thrust in units along with 6-axis location of thrusters for centralized propellant flow and micro-thrust vectoring. A comparative study has also been performed between Nitrogen and Tridyne gas for propellant safety and weight-saving high-performance operation. The control is proposed to utilize NeuraLink to keep the interface and maneuvering thought-driven, freeing hands for work. However, as contingent measure, manual control using valves is present in system design in case of electronic failure, in which the right controller would produce rotational acceleration for roll, pitch, and yaw and left controller would produce translational acceleration for moving forward-back, up-down, and left-right.

Feasible thermo-structural and flow simulation results indicate viability of the model, but require further development and tests, which is simpler due to existing base architecture, but is difficult at student level due to expenses. If successfully realized and tested this could take the future of extravehicular operations few magnitudes ahead at a frugal cost, thereby accelerating the timeline to colonization and economic development of the Interplanetary missions for the upcoming decades due to its ease in implementation for government agencies or the commercial space sector worldwide.