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Author: Mr. Samuel Gaylin United States, sgaylin@genesisesi.com

Mr. Dylan Bell United States, dbell@genesisesi.com Mr. John Harro United States, jharro@genesisesi.om Mr. Matthew Stephens

National Aeronautics and Space Administration (NASA), Goddard Space Flight Center, United States, mstephens@genesisesi.com

DEVELOPMENT OF A LOW COST COLD GAS REACTION CONTROL SYSTEM

Abstract

The Single-Person Spacecraft (SPS) is being developed by Genesis Engineering Solutions (GES) to provide the space industry with a new piloted and teleoperated EVA solution. The SPS provides a free-flyer inspection, construction, and transportation solution for host vehicles and stations such as the upcoming Lunar Gateway. Hardware is being designed and built for a demonstration mission to validate several key SPS systems in LEO. One of these systems is a cold gas Reaction Control System (RCS). The RCS serves as a near-host, general purpose maneuvering system. The overall architecture and performance specifications are modeled after that of the now retired Manned Maneuvering Unit. To achieve a low-cost solution, the propulsion system will consist of a combination of modified commercially available components, as well as hardware designed and furnished by GES. The SPS flight controller will be developed in-house in conjunction with propulsion hardware. This paper will report the performance and thermal characteristics of thermal vacuum testing for a flight-like 1.7 lbf pintle valve thruster. The thruster consists of a low-cost commercial valve modified with a precision machined nozzle to achieve the specified performance. In parallel, system-level development is taking place on a 3DOF spacecraft simulation platform. Hardware and software will be tested and developed in conjunction to operate a spacecraft analogue through the use of air-bearings. The final paper will include detailed methodology, results, and conclusions from the thermal vacuum test. The control demonstration platform assembly will be described in detail, as well as the propulsion system used for development and testing. Finally, the lessons learned and requirements derived from this phase of development will be discussed with respect to the SPS Demonstration Mission.