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# SUBORBITAL TESTING OF THE OSCAR TRASH-TO-GAS SYSTEM

**Abstract**

With the sustained human exploration of nearby celestial bodies on the horizon, a renewed outlook on waste management must be realized. Current waste management strategies aboard the International Space Station become impractical as we venture further away from low Earth orbit. One method of combatting this issue is by thermally degrading solid and liquid crew waste items into a chemically inert, ventable gas stream, a process known as Trash-to-Gas. The Orbital Syngas/Commodity Augmentation Reactor (OSCAR) is the state-of-the-art Trash-to-Gas system which has been designed to explore microgravity Trash-to-Gas concepts for improved mass and volume reduction of waste. OSCAR supports the NASA Logistics Reduction (LR) project under the Advanced Exploration System (AES) Program and Space Technology Mission Directorate Flight Opportunities Program to determine the feasibility of Trash-to-Gas technology for use on future long duration space missions. OSCAR has flown on two suborbital flight demonstrations aboard Blue Origin's New Shepard launch vehicle. This paper presents an overarching comparative analysis of these microgravity test campaigns with 1g laboratory experimentation. Percent gasification, product gas composition, soot and water production, reactor temperature and pressure, trash injection methodology, and system automation are compared to highlight the operational discrepancies within the microgravity environment for future optimization. The OSCAR system design progression and up-to-date lessons learned are also discussed for consideration into follow-on human spaceflight mission architectures.