Analysis of Alternative Jettison Design Concepts for Deep-space Missions

Jurek Parodi[1]
Bionetics Corporation, Yorktown, VA, 23693

Michael K. Ewert[2]
NASA Johnson Space Center, *Houston, TX, 77058*

Jeffrey M. Lee[3], Tra-My Justine Richardson[4], Kevin R. Martin[5]
NASA Ames Research Center, Moffett Field, CA, 94035

Gregory S. Pace[6], Janine Young[7]
KBR, Houston, TX, 77002

and

Serena Trieu[8]
Logyx LLC, Mountain View, CA, 94043

The management of waste generated onboard spacecraft during future long-duration, deep-space missions will require different solutions from those currently implemented on the International Space Station, which consist exclusively of collecting, storing, and returning the waste to Earth. Alternative options for managing spacecraft waste are to process it for recycling and recovering resources, and to jettison it overboard. The waste generated during a deep-space mission is derived mainly from spacecraft logistics supplies, food and beverage residues, personal or scientific items used by the crew, and unused spare components. Uncontained and unprocessed trash is a health hazard and a habitat volume liability, which makes onboard long-term storage a nonviable option. Jettison of solid, processed waste appear, on the other hand, to be an effective solution for crewed deep-space missions, leading not only to volume reduction and habitat safening, but also to considerable mass savings in the spacecraft's propulsion system. However, the disposal of trash overboard also creates a navigation hazard for spacecraft and the risk of collisions with planetary bodies. This paper investigates alternative jettison design concepts for L2 libration orbit, Mars conjunction-class, and Mars opposition-class missions.

[1] Aerospace Engineer, Bioengineering Branch, M/S 239-15, NASA ARC, Moffett Field, CA 94035.
[2] AES Logistics Reduction Systems Engineering and Integration Lead, Crew & Thermal Systems Division, M/S EC2, NASA JSC, 2101 NASA Parkway, Houston, TX 77058.
[3] Solid Waste Management Lead, Bioengineering Branch, M/S 239-15, NASA ARC, Moffett Field, CA 94035.
[4] Research Physical Scientist, Bioengineering Branch, M/S 239-15, NASA ARC, Moffett Field, CA 94035.
[5] Science Payload Project Manager, Flight Systems Implementation Branch, M/S 240A-3, NASA ARC, Moffett Field, CA 94035.
[6] Senior Mechanical Engineer, Bioengineering Branch, M/S 239-15, NASA ARC, Moffett Field, CA 94035.
[7] Chemical Engineer, Bioengineering Branch, M/S 239-15, NASA ARC, Moffett Field, CA 94035.
[8] Engineer, Bioengineering Branch, M/S 239-15, NASA ARC, Moffett Field, CA 94035.