

Logistics Reduction and Repurposing Technology for Long Duration Space Missions

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One of NASA's Advanced Exploration Systems (AES) projects is the Logistics Reduction and Repurposing (LRR) project, which has the goal of reducing logistics resupply items through direct and indirect means. Various technologies under development in the project will reduce the launch mass of consumables and their packaging, enable reuse and repurposing of items and make logistics tracking more efficient. Repurposing also reduces the trash burden onboard spacecraft and indirectly reduces launch mass by replacing some items on the manifest. Examples include reuse of trash as radiation shielding or propellant.

This paper provides the status of the LRR technologies in their third year of development under AES. Advanced clothing systems (ACS) are being developed to enable clothing to be worn longer, directly reducing launch mass. ACS has completed a ground exercise clothing study in preparation for an International Space Station (ISS) technology demonstration in 2014. Development of launch packaging containers and other items that can be repurposed on-orbit as part of habitation outfitting has resulted in a logistics-to-living (L2L) concept. L2L has fabricated and evaluated several multi-purpose cargo transfer bags (MCTBs) for potential reuse on orbit. Autonomous logistics management (ALM) is using radio frequency identification (RFID) to track items and thus reduce crew requirements for logistics functions. An RFID dense reader prototype is under construction and plans for integrated testing are being made. Development of a heat melt compactor (HMC) second generation unit for processing trash into compact and stable tiles is nearing completion. The HMC prototype compaction chamber has been completed and system development testing is underway. Research has been conducted on the conversion of trash-to-gas (TtG) for high levels of volume reduction and for use in propulsion systems. A steam reformation system was selected for further system definition of the TtG technology. And benefits analysis of all LRR technologies have been updated with the latest test and analysis results.

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