

Astronaut Clothing for Exploration Missions

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Astronaut clothes for exploration missions beyond low Earth orbit need to satisfy several challenges not met by the currently-used mostly-cotton clothing. A laundering system is not expected to be available, and thus soiled garments must be trashed. Jettisoning waste does not seem feasible at this time. The cabin oxygen concentration is expected to be higher than standard, and thus fabrics must better resist ignition and burning. Fabrics need to be identified that reduce logistical mass, that can be worn longer before disposal, that are at least as comfortable as cotton, and that resist ignition or that char immediately after ignition. Human factors and psychology indicate that crew well-being and morale require a variety of colors and styles to accommodate personal identity and preferences. Over the past four years, the Logistics Reduction Project under NASA's Advanced Exploration Systems Program has sponsored the Advanced Clothing System Task to conduct several ground studies and one ISS study. These studies have evaluated length of wear and personal preferences of commercially-available exercise- and routine-wear garments made from several fabrics (cotton, polyester, Merino wool, and modacrylic), woven and knitted. Note that Merino wool and modacrylic char like cotton in ambient air, while polyester unacceptably melts. This paper focuses on the two components of an International Space Station study, onboard and on the ground, with astronauts and cosmonauts. Fabrics were randomized to participants. Length of wear was assessed by statistical survival analysis, and preference by exact binomial confidence limits. Merino wool and modacrylic t-shirts were worn longer on average than polyester t-shirts. Interestingly, self-assessed preferences were inconsistent with length-of-wear behavior, as polyester was preferred to Merino wool and modacrylic.

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