Inflatable Shelter for Extraterrestrial Protection

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NASA suggests humans will be on the surface of Mars by the 2030s. Much of the Martian surface is yet to be explored. Mars rovers must be robust enough to handle extreme temperatures, harsh radiation, and severe wind and dust storms. Launch costs are expensive for large and heavy space vehicles. Using small systems can lower costs, allowing for more missions and further surface exploration. However, these smaller systems must still be able to withstand Mars's surface conditions.

We propose an inflatable shelter for Martian explorers that protects rovers from dust storms, radiation, and extreme temperature fluctuations. Inflatable technology allows for compact and lightweight packaging and is the perfect addition to small rovers exploring the Martian surface. Rovers enter the garage to escape extreme surface conditions. The system utilizes hydrophobic, dust-repelling materials, cleaning brushes, and dust mitigation plates to clean off the rover and sensitive instruments. The walls insulate and regulate the internal temperature of the shelter for the rover. Additional benefits such as data storage and backup, charging, and communication are available to the rover, increasing system redundancy and failure mitigation. This technology enables small-scale rovers to be robust enough to effectively explore the Martian environment.

For future human exploration, this design also acts as a proof of concept for airlocks and internal pressurization for Martian habitats. Inflatable technology is often suggested for use in Lunar and Mars habitats, as it can be compressed tightly for launch and expanded to large volumes once on the surface. It can be designed to be internally pressurized, which is necessary for future human astronauts operating on the surface. Pressurizing the internal inflatable shelter allows us to verify this technology before testing with humans, reducing overall risk.

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