

Cryogenic Thermosuit for Manned Mission to Titan

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Titan, Saturn's largest moon, presents an enormous amount of scientific potential. While probes have been sent to the planet before, consideration of a future manned mission provides its own unique challenges. Titan's average surface temperature is -290 degrees Fahrenheit, nearly as low as the boiling point of liquid nitrogen. While its dense atmosphere means a pressurized spacesuit isn't necessary, humans would need a way to protect themselves from the incredible cold if they were to explore the moon. The goal of this research was to set the foundation for developing a Cryogenic Thermosuit that would effectively protect the human body from conditions on Titan. By subjecting a control volume of heated water within an insulating glove to liquid nitrogen temperatures, the protective properties of different layers of insulating materials were determined and compared to one another. Materials such as Thinsulate, Gore-Tex, fleece, fibrous aerogel batting, and space blankets were used to make multilayered gloves. The gloves protect a control volume, simulating the human hand, with tubing providing heated water to simulate blood flow. When the temperature of the control volume drops below healthy human body temperature, a heater turns on and returns the control volume to stable temperature. Over the course of a given period of time, if more heat has to be added than the human body can provide on its own, the glove is not sufficiently protecting the human body from Titan's environment. The Cryogenic Thermosuit aims to work toward a manned mission to Titan, as well as having applications on other planets, the dark side of the moon, and even here in Earth's most extreme cold weather environments.

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