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Solar cells comparison in high altitude. (U)*

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The intent of this project was to compare the electrical outputs of two types of solar cells under different treatments in a high altitude and low atmosphere environment. Four cells were compared: a standard photovoltaic (PV) cell, a Gallium Antimonide (GaSb) thermophotovoltaic (TPV) cell sensitive to infrared radiation, and another pair of PV and TPV cells under Fresnel lenses treatment (PV-F, TPV-F). The cells were mounted on a custom-designed scientific payload, which was integrated on a high altitude balloon launched at NASA's Columbia Scientific Balloon Facility location in Fort Sumner, New Mexico. The payload data were collected throughout the balloon's ascent, and at the balloon's float altitude of approximately 33km. Analysis of the results, when normalized for difference in surface area between cells, suggest that the PV cells consistently produced more current than the TPV cells, both with and without Fresnel lenses. The PV cell produced an average of 1.498 times more current than the TPV cell, while the PV-F cell produced an average of 1.611 times more current than the TPV-F cell. Additionally, the PV cell produced an average of 1.574 times more current than the PV-F cell, while the TPV cell produced an average of 1.693 times more current than the TPV-F cell. Therefore, the data suggest that PV cells perform better than TPV cells, and that Fresnel lenses decrease the output of both cell types. Further exploration of the results in a current/time analysis showed a strong correlation between the PV and TPV cells, and a strong correlation between the PV-F and TPV-F cells, with different trends appearing in each pair of data comparisons. Analysis of the variation in trends in data between the PV and TPV cells and the PV-F and TPV-F cells allowed for conclusions regarding the reasons for the overall hindrance caused by the Fresnel lenses during flight. Comparing the performance of PV cells and TPV cells, it is clear that the current technology used in TPV cells do not make them viable for high altitude applications.

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