Study of Integrating Reflectarray with Solar Panels for Small Satellite Applications

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CubeSats have been playing unique roles in space exploration and become critical tools for space missions. Early CubeSat antennas were mainly very simple omni-directional as the communication needs were basic. As future missions call for much higher data rates and gains, it is desirable to have antennas with more capacity to be equipped on CubeSats. Deployed light weight reflector antenna has been recently reported (N. Chahat et al., APS 2015, Vancouver, Canada) for a 1.5U CubeSat, and NASA has reported ISARA where a Ka band planar array has been integrated on the back side of the solar panel. ISARA is not necessarily for CubeSats, and does not need deployment. The challenges with the two types of high gain antenna are, the first kind needs deployment and the second kind cannot be integrated on the same side with solar cells because the antenna elements will compete for the surface real estate with solar cells.

As it is common that today's multi-unit CubeSats have sufficient-sized solar panel, additional deployed panels with solar cells on both sides, it is favorable to design optically transparent reflectarray that can be integrated directly on top of solar cells. In our previous studies on optically transparent antennas and their integration with solar cells, we have demonstrated methods to design highly transparent antennas and have assessed how the solar cell and the antenna affect each others functionality. Using those data as entry points, this study is aimed to design an optically transparent reflectarray with modular transparent elements integrated on the cover glass of solar cells. Such a design method is an alternative and a more flexible solution to the NASA Ames' ISARA.

This paper reports our latest development in the transparent solar panel reflectarray design.