

## **Conformal Integrated Solar Panel Antennas for CubeSats**

Benjamin B. Oborn\* <sup>(1)</sup> and Reyhan Baktur<sup>(1)</sup>

(1) Utah State University, Logan, UT, 84322, <http://www.usu.edu>

A CubeSat is a miniaturized, modular satellite with a very small payload. Everything from their electronics to their structure is often constructed entirely of off-the-shelf components. Since the development of their specifications, CubeSats have not only found popularity in university-student-led educational and research projects, but are also becoming important space exploration tools. Due to their small size, low cost and versatility, CubeSats can be used to test technologies that are planned for use on larger satellites, to collect point-to-point data in space when launched as CubeSat constellations, or to monitor health of larger spacecraft. However, their small size also presents some challenges. For instance, designing their antennas for use in radio-communication systems in the VHF, UHF, L-, S-, C-, X-, and Ka-bands. Typically, CubeSats in Low Earth Orbit (LEO) use less directional antennas for communication purposes in UHF and S-bands. Conversely, when farther in the solar system, high gain antennas, compatible with the Deep Space Network (X-band and Ka-band), are required. Mechanically deployed wire antennas are used frequently in these applications. However, they add to the size, weight and complexity of the payload in an environment where payload reduction, while increasing mission capability and reliability, is always a major concern.

One way to reduce payload is to eliminate the mechanically deployed wire antennas and to replace them with antennas conformal to the CubeSat surface. This simultaneously reduces the cost of deployment as well as the risk of communication failure if the antennas fail to extrude. As most CubeSats have surface-mount solar panels as their primary power generation unit, integration of conformal antennas on solar cells is particularly valuable for CubeSat communication. This is because the antennas, when strategically integrated with the solar cells, do not compete for the limited surface real estate and do not require mechanical deployment.

This paper reviews several different conformal antenna designs that can be integrated with CubeSats' solar panels with minimal effect on solar cell functionality. The conformal designs reviewed include omnidirectional UHF and S-band antennas and high gain X- and Ka-band reflectarray antennas.