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INNOVATIVE SYNTHETIC APERTURE RADAR FOR THE SMALL SATELLITES

Abstract

Synthetic Aperture Radar (SAR) is a well-known remote sensing technique to obtain radiolocation images of terrain. Many spaceborne SAR systems currently in use or planned are multifunctional. Their designs tend to make multiple image modes available to the end user. Traditional multifunction SAR usually has large antenna and needs even larger spacecraft. Recent trend to make SARs for the small spacecraft, on the contrary, emphasizes simplicity and minimal features. More importantly, this approach limits performance objectives to spatial resolution and does not take into account other important metrics. This paper outlines various SAR performance metrics. We will describe their interdependence and relationships with instrument mass and power. Based on these estimates, we introduce the novel SAR architecture. It is suitable for the small spacecraft and is able to provide significant mass and power savings compared to the traditional phased arrays. Modular architecture and digital beamforming enable quick adaptation to various mission profiles and performance rivalling much more bulky and expensive systems. The first implementation works in the C-band, that makes it suitable for the all-weather imaging of the tropic regions. This instrument features 1.5 m spatial resolution, full polarization matrix imaging, up to 20 km swath and flexible imaging modes. It will be tested on the International Space Station. The paper presents engineering models test results, as well as test campaign of the subscale model installed on the UAV.