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A CUBESAT BASED GNSS CONSTELLATION FOR PLANETARY EXPLORATION

Abstract

The global space economy reached USD329 bn in 2016, having grown on average by 5.1Today's GNSS utilise Hydrogen MASER, Rubidium and Caesium-based Atomic Clocks to achieve highest accuracy and availability for positioning and timing purposes. Of all these Atomic Frequency Standards, the Rubidium-based Atomic Clocks are by far the smallest, lightest and cheapest ones, which would make them the natural candidate for a CubeSat-based GNSS constellation. However, this small form factor comes with a significant drawback - limited accuracy and stability. As such, a pure Rb-based GNSS may not satisfy today's GNSS requirements. But what is a 'no-go' for terrestrial applications will still be of high value when it comes to planetary exploration. Building up an infrastructure on the Moon, Mars or the asteroids requires landing accuracies in the order of 10-20m to ensure that all elements land in close vicinity to each other. So while a CubeSat-based GNSS Constellation may not (yet) satisfy the stringent requirements of terrestrial applications/services, it may still provide for an invaluable planetary exploration infrastructure, especially when it is possible to use the very same GNSS constellation for communication and remote sensing purposes. Bearing this in mind, this paper will discuss the key requirements, constraints and considerations, which drive the design and set-up of such a CubeSat based GNSS Constellation, which will likely become an indispensable infrastructure for any planetary exploration activity that goes beyond the one-off-visit type.