Paper ID: 46958
interactive
student

25th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Spacecraft for Deep-Space Exploration (8)

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A MINIMAL CHIPSAT INTERSTELLAR MISSION: TECHNOLOGY AND MISSION ARCHITECTURE

Abstract

Thanks to the recent development of nano-technologies, the miniaturization capacity of electronics and the development of new materials, the realization of extremely small satellites - capable of achieving significant tasks - is becoming increasingly feasible. Such devices, which combine cost-effectiveness with high performance, are becoming more popular with universities and small research groups for these properties. They are known as ChipSats.

This paper assesses the feasibility of a ChipSat for a particular application, namely an interstellar mission to the closest star, Proxima Centauri, in a reasonable timeframe. The ChipSat, equipped with a solar sail or another propulsion systems, would escape the Solar System, travel to the target and send back a telemetry signal. Given that reduced dimensions are one of ChipSats most interesting features, three different scenarios have been considered for an initial trade-off, differing in the way the ChipSat is released. The possibilities that have been evaluated are the following: the release from i) a Deep Space Gateway located in L2, ii) an International Space Station orbiting around Earth, iii) another spacecraft for space exploration. The technology readiness level is considered to be based on latest technology available and an eventual development that is foreseen in the next 20 years, but no longer. The focus of the research is on propulsion, communication and power issues, since these would be the key limiting factors for such a mission.

This study aims to demonstrate the great effectiveness of ChipSats and to suggest an adequate interstellar mission architecture enhancing their peculiar features trying, at the same time, to overcome their well-known weaknesses, such as low power availability and poor communication capabilities.