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## DEEP SPACE SMALL SATELLITE COMMUNICATION SYSTEM AND ANTENNA DESIGN

**Abstract**

Privatization of Space industry has initiated a new race for space exploration, where public, private, society and politics would come together to plan and support space missions to put human presence in deep space. The innovations and miniaturization of technology has enabled low cost deep space missions which were not possible before. The new space has commercial outlook and this is the reason why private money will inflow soon into this industry. Having a human space history and a lot of useful resources, moon has become a very strategic celestial body for human space exploration. Space agencies like ESA has publically declared to build and support Moon Village and NASA has started an initiative called COTS (Commercial Orbit Transport Service) with a view to have a cooperative efforts of public and private sector to do space exploration. Many studies regarding different lunar architectures like communication, mining, etc. have been studied and are being studied to estimate challenges and risks of such missions. This paper will explain the communication architecture required to support lunar infrastructure development. The expected performance of lunar relay constellation would be explained based on link budget calculations. Different orbit maneuvers with selected lunar orbit and its importance will be addressed in this paper. Based on link budget calculations a functional block diagram of a communication system is discussed and prototype is developed. The communication system prototype is designed for CubeSat missions. The state of the art technologies used to optimize the performance of this system are Software Defined Radio and additive manufactured small satellite patch antennae.