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TOWARDS 6G IN SPACE : TECHNOLOGY VECTORS AND CHALLENGES.

**Abstract**

NASA's lunar Gateway will serve as a staging post for the exploration of the moon and deep space. With the establishment of the Gateway, there will be a significant increase in data traffic between Earth, lunar gateway, Mars, and other deep space probes.

Projecting current technology vectors, it is safe to assume that sub-millimeter technologies will play a significant role in providing the infrastructure that will support 6G applications for terrestrial applications.

This paper will report new concept for interplanetary communications combining optical communications between interplanetary bodies and sub-mm wave technologies to connect earth to other planets including Mars enabling very low latency, wide band connectivity of the solar system. Details of a deep space laser communications system will be described along with measured and simulated results of a prototype that was recently developed.

Additionally, an ultra-compact W-Band power amplifier that delivered over 5 W of output power at 94 GHz, using spatial power combing techniques will be described. The optical and mm-wave PA modules are two critical elements that complete the communications link that could provide near seamless, low latency connectivity between earth, moon and mars in the future, paving the way for successful human exploration and eventual colonization of Mars.