

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Near-Earth and Interplanetary Communications (5)

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ON THE POTENTIAL OF OPTICAL TELEMETRY TRANSMISSION ON INTERPLANETARY  
MISSIONS

**Abstract**

Laser communications (Lasercomm) can offer an increase in telemetry bandwidth over classical RF technology allowing for a variety of new options, specifically to missions that require very large distances, such as to the Moon, to Liberation points L1 and L2, eventually aiming at deep space missions. This increase in telemetry data rate allows for enhanced sensing techniques that generate more science data return and the mission may consider the processing of raw scientific data to take place on ground, there using latest computing technology that may have been further developed during the cruise phase of the probe.

Free space laser communications are being established today in routine operation in near Earth orbits. Various successful space laser communications activities were carried out worldwide, and many successful demonstrations have prepared the way for implementation of lasercom also at interplanetary distances. Important to mention, Cloud coverage statistics during measurement campaigns complement analytical predictions from international forecast systems and they show that lasercom can directly reach the ground at high availability using a few global distributed ground stations.

Since 2003, RUAG Space is investigating together with ESA the optimal use of lasercommunications for an integrated RF-optical TTC subsystem for interplanetary telecommunications that link from a deep space probe directly back to an optical ground receiver. A key issue involved is the optimal modulation format. PPM lasercomm was found to provide many advantages over established communications subsystems, especially for very large link distances. In frame of an ESA contract, RUAG Space has developed a PPM optical breadboard for robustness tests of the chosen modulation format with respect to atmospheric channel impacts. In this paper, inter-island test results from two inter-island test campaigns are reviewed and the potential of a further increase of data rates is outlined by predictions on use of an intensified photo detector concept. Currently RUAG Space is involved in an ESA study on a technology review to support optical telemetry on missions to exploration of the solar system. The concept of large aperture, "photon bucket" type of receiver stations is reviewed, taking into account the potential of 1550nm technologies in combination with a tailored design approach to existing Gamma-Ray Observatories like MAGIC on La Palma.