IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advances in Space-based Communication Systems and Services, Part 1 (2)

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A MONITORING, CONTROL & AUTOMATION SYSTEM FOR OPTICAL COMMUNICATION GROUND STATIONS

Abstract

Advancements in sensor technology onboard satellites combined with frequent launch opportunities have led to a large volume of data generation in space. The conventional radio frequency-based communications pose a bottleneck for data downlinks. Recent research has shown that optical-based communication can achieve much higher data throughput. DLR-GSOC is building its first robotic telescope station called the Free-space Optical Ground Antenna TAbernas (FOGATA) to be fully operational by the end of 2022. It utilizes laser-based space-to-ground communications at near-infrared (NIR) wavelengths. This optical ground station (OGS) will be contributing to the European nucleus network of OGS pursued by ESA and DLR, jointly with their commercial partners KSAT and TESAT. To meet the industry's high availability requirements, FOGATA aims to be fully automated. Here, the monitoring and control (M&C) system developed in-house allows for automating satellite passes without the need but offers the possibility of human interaction. With this newly developed system, the customers can book their satellite passes remotely via the internet. The passes are then scheduled automatically with the dedicated ground stations using a CCSDS standardized approach. Thus, ensuring compatibility with different agencies and customers. This paper explains in detail the software architecture of the M&C system, the various device drivers supported, closed-loop tracking using an infrared camera and image processing, and the automation process of the system. While the FOGATA in Almeria will be DLR-GSOC's core ground station, a modified version of the M&C system is also planned to be implemented for the upcoming OGS in New Zealand, as part of a collaboration between DLR and the University of Auckland.