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TECHNICAL CAPABILITIES OF ONLINE GROUND STATION FOR MULTI-SATELLITE COMMUNICATIONS

Abstract

Universities and other organizations involved with satellites always desire a quick communication link upon launch and deployment to verify orbit insertion and initial telemetry. Per usual, the satellite's orbital parameters determine the coverage area (as indicated by a ground trace). The satellite-ground station (GS) line-of-sight communication duration (pass time) varies for each pass depending on the local horizon (Azimuth and Elevation angles), antenna characteristics and satellite orientation. For many satellites the link is established approximately 5 to 7 degrees above the horizon. But ground stations located in an urban environment face additional difficulties due to towers and other obstructions.

In this paper, we discuss the technical details of the HERMES-A / MINOTAUR GS built by the Ecuadorian Civilian Space Agency (EXA) an internet-to-orbit gateway available for the public use. This gateway virtually connects participating clients around the world with the capability to access LEO satellites remotely both with data and voice transmissions. HERMES can also be automated by the user to track LEO satellites via a schedule, a boon for long term operations.

The GS has sensitivity as low as 0.1 Watts with a range up to 22,000 km. Since this GS is located in an urban area, the communication at low elevation angles can be hindered through natural barriers and/or man-made noise. For this paper, experiments were carried out to verify the technical capabilities of the HERMES GS in preparation of its use as a remote and automatic satellite GS. Because HERMES is only the first of a series of ground stations, the data collected regarding automatic operations will be critical for future use. With several stations operating automatically, a user anywhere in the world can connect, monitor and control a formation of satellites from their single laptop computer, a capability that has not been realized by the CubeSat / Small Satellite community.

Until now, results were obtained by remotely controlling and simultaneously downloading real-time data and voice by users located on four continents, taking into account the relationship of horizon with satellite pass time (loss of satellite/signal – acquisition of satellite/signal), and interference phenomena . Results of these coordinated studies will be presented in this paper to inform the community about latency effects and the advantages that automatic operations may provide. We close the paper with a case-study, using HERMES data, of a coordinated GS network, operated remotely, that can be utilized for formation satellite communications.