Paper ID: 31676
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SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Space Communications and Navigation Young Professionals Virtual Forum (8-YPVF.3)

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IMPROVING SPACE COMMUNICATION AND NAVIGATION (SCAN) OPTICAL SATELLITE LINK ASSESSMENT TOOL

Abstract

Optical communication through free space with the use of lasers provides higher bandwidth than radio-frequency communication and can increase cumulative data return over the lifetime of a mission. To assess an optical link's reliability, link budget calculations are made to account for all the gains and losses, through free space, between the transmitter and receiver. The SCaN Optical Satellite Link Assessment Tool is a software tool enabling optical systems designers to make link budget calculations dynamically for the entirety of a mission scenario. In order to improve the accuracy of link budget calculations, the changes in sky and planetary irradiance seen by the optical receiver must be accounted for dynamically. In addition, data rate is an input parameter in link budget calculations but the ability to solve for data rate, by holding other variables constant, will allow for analysis of achievable data rates throughout a mission scenario. This project's first goal is to account for sky and planetary irradiance dynamically using third-party software Systems Tool Kit (STK) and its Electro Optical and its Infrared Sensor (EOIR) module. STK and EOIR programming interface is used to map irradiance calculations into the Optical Satellite Link Assessment Tool. The second goal is to create a new feature within the tool allowing a user to specify a desired link margin amount and solves for the corresponding data rates over a mission. A binary search algorithm is implemented to ensure faster than linear performance when approximating the corresponding data rate that satisfy the desired link margin value. The result of the project is improved accuracy of link budget calculations by factoring in dynamic background irradiance calculations and a completed feature to calculate data rates that satisfy a specific link margin over a mission scenario.