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DEVELOPMENTS OF THE LASER COMMUNICATION MODULES BETWEEN SMALL-SATELLITE AND MOBILE GROUND STATIONS

Abstract

In those days, the development and use of small-satellite for business venture are becoming popular globally. One of the causes is the increasing demand of remote sensing using small-satellite. Observation data from small-satellite constellation is increasing and there is ever-greater demand for radio wave resources. However, radio wave frequency bands are limited resources and little resources are remaining. Therefore, as a solution of this problem, there is free space optical (FSO) communication technology using laser. Laser is not included in radio spectrum and restricted by technical standards of ITU (International Telecommunication Union). This technology is researched and developed by ESA (European Space Agency), JAXA, NICT (National Institute of Information and Communications Technology), NASA and so on. NICT developed Small Optical TrAnsponder (SOTA) and made experiments of micro-satellite-ground laser communication. However, this technology has been used just experimental or high cost satellites until now and has not used general small-satellite. Because of the increase of small-satellite constellation, simple optical communication module and ground stations are needed. Against these background, the objective of this study is to develop the useful package of optical receive ground station and to develop the compact transmit system. These systems can be incorporated not only in our small-satellite which we are developing now for the purpose of hyperspectral remote-sensing, but also in other polar orbiting small-satellite polar orbit. Being used for business venture, optical communication module needs many ground stations for Site diversity. It's because that optical communication is vulnerable to rain or cloud fade. Therefore, our ground station is low cost and small. Specifically, the diameter its telescope is about 50 centimeters. We have been developing a BBM communication module and making experiments at the range of 10km. Accuracy of directional control is 63 micro-radians. On experiments at the range of 1km, we had bit error rate 10 to the power of minus 7 which was enough to use for orbit-ground communication. Because of this result, the BBM is reasonable as the bread board model of optical transmit-receive system. The first status of our project is to demonstrate the laser communication being the major means of communication between a small-satellite and ground stations.