SPACE SYSTEMS SYMPOSIUM (D1)
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Author: Mr. Xinsheng Wang
Beihang University, China, xswang@buaa.edu.cn

Mr. bo lee
Beihang University, China, liboy@sa.buaa.edu.cn
Mr. Kaixing Zhou
Beihang University, China, kxing@sa.buaa.edu.cn
Mr. Yongchao Dai
Beihang University, China, kuang_dyc@163.com

RESPONSIVE NANOSAT COMMUNICATION CONSTELLATION FOR THE ASIAN-PACIFIC REGION

Abstract

The Asian-Pacific region frequently subjects to severe natural disasters attack, which brings about great difficulty for external rescue. NanoSat is a satellite about 10kg weight with advantages of short development cycle, low cost manufacture and testmission-oriented design and easy to build low-cost mutisatellite constellation. The Responsive Nanosat Communication Constellation (RNCC) project was proposed by Beihang University (BUAA), which can provide a type of responsive amateur radio (UHF/VHF) communication service in harsh environment. In the absence of a disaster, RNCC is dedicated for educational and scientific purposes. The paper presents the RNCC mission description, RNCC system design and analysis, key nanosat subsystems technical design, ground segment design, etc.

The constellation consists of 5 nanosats, each weighing less than 10 kg. The orbit design has been detail analysized. All the nanosats will be launched as piggyback and work on coplanar sun-synchronous orbits at 800km. The users can use handheld and low-cost ground facilities for audio and data communication with the constellation.

Every nanosat has three UHF/VHF transceivers, which are used for telemetry and remote control, audio transmission and data transmission separately. The hardware of the three transceivers is the same, one can work as a backup by reconfiguration when another breaks down. All the radio components use amateur radio frequencies and the AX.25 protocol. In order to make the responsive communication link reliably, both the antennae of the ground stations and the nanosats are designed omnidirectionally. The uplink channels use VHF, while the downlink channels use UHF. Only the satellite control centre has the authority of satellite management and operation, while normal users could use communication services. The two kinds of communication service are: (a) Audio transmission: this is available when a nanosat is in an orbital region which is visible for two users. In this case, two users can listen and speak to each other as well as transmit real-time data. This is just likes using interphone. (b) Data transmission: this is available when two users are in different areas of coverage. In this case, a nanosat receives and stores messages from the user and transmits them down to the ground when it passes by another user.

The paper describes the design of the RNCC, the technology challenges and provides an overview of expected performances.