SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
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TESTING VOR PERFORMANCES IN THE STRATOSPHERE: THE STRATONAV EXPERIMENT

Abstract

The VOR (VHF Omnidirectional Range) system has been used for decades as primary navigation aid to civil aviation and is used nowadays by commercial aircraft as back-up for GNSS (Global Navigation Satellite Systems). The STRATONAV (STRATOspheric NAVigation) experiment purpose is to test the VOR system in stratosphere during a stratospheric balloon flight in order to evaluate the performances of this radio-navigation system above its standard service volume. The experiment, developed by an Italian student team from Sapienza - University of Rome and Alma Mater Studiorum - University of Bologna, has been proposed during the 2015 call of REXUS/BEXUS (Rocket and Balloon EXperiments for University Students) Programme and selected for BEXUS 22 flight from Kiruna, Sweden, scheduled in October 2016. The VOR stations service volume estimation is based on the International Civil Aviation Organization (ICAO) prescribed radiated power rates: a high altitude VOR navigation station shall ensure its service at least until 18 km in height with prescribed precision rates of 1.4 degrees in radial evaluation. The flight of the BEXUS balloon will reach an altitude of at least 20 km above ground level during the floating phase. STRATONAV experiment is designed to tune its on-board receiver to the optimal VOR station frequency by evaluating the estimated service volumes and the GPS balloon positioning data in order to collect VOR radial data. BEXUS will be launched from the Esrange Space Center in Kiruna (Sweden) and the area nearby is equipped with multiple VOR high altitude navigation stations. The expected balloon flight path has been computed by analyzing previous BEXUS flight and the results show that intersections of two or more VOR standard service volumes are revealed for the whole flight. The presented paper shows the experiment design and system studied to investigate the accuracy of the VOR system in stratosphere and to perform a stand-alone VOR positioning by interfacing two or more VOR radials evaluated from

different ground stations in order to compute the balloon ground track. Moreover, the methodology that will be performed to analyze the post-flight collected VOR radials will be presented.