Paper ID: 15959
oral

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Mobile Satellite Communications and Navigation Technology (5)

Author: Mr. Alex Budianu
University of Twente, The Netherlands, a.budianu@utwente.nl

Mr. Teodoro Willink Castro
University of Twente, The Netherlands, t.j.willinkcastro@student.utwente.nl
Dr. Arjan Meijerink
University of Twente, The Netherlands, a.meijerink@utwente.nl
Dr. Mark Bentum
University of Twente, The Netherlands, m.j.bentum@utwente.nl

COMMUNICATION SCHEMES FOR OLFAR'S INTER-SATELLITE LINKS

Abstract

The evolution and ongoing miniaturization of technology has acted as a catalyst in the development of space equipment. New types of flight hardware (e.g. nano-satellites) have emerged and, with these, a range of new applications. For radio astronomers, nano-satellites enhanced the possibilities of doing new science in space, and created the opportunity of exploring the cosmos in the ultra-long wavelength domain.

The Orbiting Low Frequency Array for Radio astronomy (OLFAR) project is aimed at developing a radio telescope in space sensitive for the 0.3–30 MHz domain by using a swarm of more than 50 identical nano-satellites. The satellites will form a very large aperture, capable of capturing the desired very weak EM waves. They will collect data, process it in a distributed manner, and send the result to a base station on Earth.

The imaging process and the design constraints of the swarm result in strict requirements for the communication layer, particularly the inter-satellite links. For the distributed correlation it is needed that satellites transmit their captured astronomical data, position, time and other meta information to all the members of the swarm. Clustering will be employed to reduce the data distribution efforts and decrease the length of the links as we proved in earlier work. The requirements will then be more lenient for the majority of nodes in the network, except for the backbone nodes. In order to cope with the high rates of the observed data (> 6 Mbit/s) and large distances between the satellites (up to 100 km), an appropriate communication scheme must be used.

In this paper we address existing modulation techniques and multiple access methods from the nano-satellites' perspective. Driven by the scientific goal of the project, we design the communication layer of the swarm while also taking into account size and power constraints of the space hardware. Finally, a digital communication scheme for nano-satellites that supports both normal and backbone functionalities is presented.