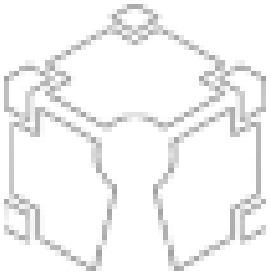

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ASTRE/Tolosat abstract

ASTRE (students' space research association of Toulouse) is a student space association run by university students in collaboration with professors and the CSUT (University space center of Toulouse). The main objective of ASTRE is to develop student interest for space science and technology by developing engineering projects. ASTRE also aims at becoming an organization where students from Toulouse could share their knowledge of space with other students.

The ASTRE's first project is a 2U Cubesat called Tolosat. 30 students from 4 different schools and various fields work in this project. The main objectives of Tolosat are:

1. Prove that GNSS-r (Global Navigation Satellite System – reflectometry) altimetry can be realized by a 2U CubeSat:
   Earth is bathed in GNSS signals. Usually, these signals are exploited for geo-localization. However, GNSS-r technology offers using GNSS reflected signals to have information about the Earth surface (soil humidity, roughness ...). Tolosat aims at using GNSS-r technology for topographic mapping of the Earth surface using Galileo signals. The concept of this mission is based on Valery U. ZAVOROTNY's paper called "Tutorial on Remote Sensing Using GNSS Bistatic Radar of Opportunity". A first analysis shows that large surfaces of plane water, like the lakes, will increase the signal to noise ratio (SNR) of the reflected signal making it a good option for GNSS-r altimetry demonstration on a Cubesat.
2. Establish an SSH (Secure Shell) link with IRIDIUM satellite constellation in order to communicate with Tolosat from Earth at any moment when the spacecraft is in range of the IRIDIUM constellation:
   One main problem of Earth communication with satellites is the localization of the ground stations. There are some Earth places, like the oceans, where large antennas cannot be deployed in order to communicate with the satellites. As a consequence, Tolosat aims at proving that communication with a satellite can be established using IRIDIUM constellation as a relay.

Tolosat project is currently on phase A: a feasibility study is being developed. As sharing the knowledge is one of the first objectives of the ASTRE association, open source solution are being studied for the design of Tolosat space mission. Libre Space Foundation open source ground stations are being analyzed by the mission analysis team as well as other possibilities of open source hardware and software.

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