EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

Author: Dr. Bernard Foulon
Office National d'Etudes et de Recherches Aérospatiales (ONERA), France, bernard.foulon@onera.fr

Dr. Phuong-Anh Huynh
Office National d'Etudes et de Recherches Aérospatiales (ONERA), France, phuong-anh.huynh@onera.fr
Mr. Damien Boulanger
Office National d'Etudes et de Recherches Aérospatiales (ONERA), France, damien.boulanger@onera.fr
Mrs. Françoise Liorzou
Office National d'Etudes et de Recherches Aérospatiales (ONERA), France, francoise.liorzou@onera.fr
Dr. Bruno Christophe
Office National d'Etudes et de Recherches Aérospatiales (ONERA), France, bruno.christophe@onera.fr

THE MICROSTAR ACCELEROMETER, A KEY PAYLOAD FOR LOW EARTH ORBIT AERONOMY MISSION

Abstract

With its mature technology inherited from the still in-orbit electrostatic accelerometers of the GRACE and GOCE geodesy missions, the MicroSTAR accelerometer is well suited for low Earth orbit aeronomy missions. Weighting 1 kg inside less than 1 litre and with a power consumption of a little bit more than 1 W, MicroSTAR can be integrated both as auxiliary passenger payload on board any Earth observation satellite either can be the main payload of a micro satellite dedicated to aeronomy and space weather survey. Positioned in the vicinity of the spacecraft centre of gravity, the accelerometer provides the measurements of the satellite non gravitational surface forces. Associated with a precise orbit determination, the accelerometer measurement permits to distinguish the position or velocity fluctuations of the satellite due to the drag fluctuations from those due to the Earth gravity anomalies and so to deduce the atmospheric density after removal of radiation pressures (direct solar, Earth albedo and infrared radiation) assuming a well known mass and wetted surface of the satellite. MicroSTAR shall achieve a resolution performance up to $1.5 \times 10^{-11} \mathrm{m} \cdot \mathrm{s}^{-2} \cdot \mathrm{Hz}^{-1/2}$ in the measurement bandwidth from 0.2 mHz to 100 mHz. If integrated at the centre of a nearly spherical micro-satellite, taking advantage of a GPS receiver for precise orbit determination and with a simple mechanical devices for accurate in-orbit centring at the satellite centre of gravity, such a satellite launched on a 300 km-1300 km orbit with inclination as close as possible to a polar orbit, can provide a global coverage of the upper atmospheric density and of its spatial and temporal variations. After a description of the MicroSTAR instrument, the paper will presents its detailed performance budget and it will be concluded by a short trade off between the possible orbits and the expected scientific performance return pending on the potential LEO satellite missions.