Geophysical Research Abstracts
Vol. 12, EGU2010-2349, 2010
EGU General Assembly 2010

Microsatellite Digital Magnetometer SMILE – Present State and Future Trends

Serhiy Belyayev (1) and Nickolay Ivchenko (2)

(1) 1Lviv Centre of Institute for Space Research, Lviv, Ukraine (belyayev@isr.lviv.ua), (2) Royal Institute of Technology (KTH), Stockholm, Sweden (nickolay@kth.se)

The fluxgate magnetometers (FGM) are probably the most widespread instruments used onboard spacecrafts for both scientific and service purposes. The recent trend to decrease the weight and size of the spacecrafts requires creating as small as possible but enough sensitive FGM. A joint Swedish-Ukrainian team made the development of such a magnetometer and as the result the Small Magnetometer In Low mass Experiment (SMILE) - a digital fluxgate microsatellite magnetometer – was created [1]. Majority of electronic units of this FGM were combined in a digital integrated circuit - a Field Programmable Gate Array (FPGA). The FPGA provides full processing (determined by a digital correlation algorithm) of amplified and digitized fluxgate sensor output signals and provides both FGM output data and feedback signals. Such digital design makes the instrument very flexible, reduces power consumption and opens possibilities for customization of the operation modes. It allows miniaturizing the electronic unit and, together with the smallest in the world low noise three-component fluxgate sensor with the side dimension of 20 mm and weight about 20 grams only, the small but enough sensitive space qualified FGM is created. SMILE magnetometer was successfully flown onboard the NASA Cascades-2 sounding rocket, and is to fly in the LAPLander package onboard the ESA REXUS-8 student sounding rocket [2].
Unfortunately, such a design of electronic circuit does not allow us to realize all possibilities of the miniature sensor. The separate tests of the sensor with highest-class analog electronics showed that its noise level may be reduced to as low value as 10…15 picoTesla at 1 Hz. Also the use of volume compensation in the sensor provides high geometrical stability of the axes and improved performance compared to component compensated sensors. The measured parameters appear to be comparable or even better than these of best stationary FGM and, if realized in small enough volume and weight, such a sensitive but small FGM could be a good candidate for planned Lunar missions where the weight is the major restriction factor. This stimulated further research in the direction of the analysis and elimination of noise sources of digital design, as well as of the optimization of FGM electronic circuit structure.
The description of the obtained results of the electronic unit upgrade and recent FGM model tests are given and future improvement directions are discussed.
These works are partially supported by NSAU contract No. 1499.

References:
1. Åke Forslund, Serhiy Belyayev, Nickolay Ivchenko, Göran Olsson, Terry Edberg and Andriy Marusenkov, Miniaturized digital fluxgate magnetometer for small spacecraft applications 2008 Meas. Sci. Technol. 19
2. T. Sundberg, N. Ivchenko, D. Borglund, P. Ahlen, M. Gustavsson, C. Jonsson, J. Juhlen, O. Neunet, J. Sandstrom, E. Sund, M. Wartelski, C. Westlund, L. Xin, Small Recoverable Payload for Deployable Sounding Rocket Experiments. ESA Special Publication SP671