TUMNANOSAT NANOSATELLITE AND KIBOCUBE PROGRAM

Viorel BOSTAN[1], Nicolae SECRIERU[1], Valentin ILCO[1], Vladimir MELNIC[1], Alexei MARTINIUC[1], Vlad VARZARU[1]

[1] National Center Space Technologies, Technical University of Moldova, Chisinau, Rep. of Moldova
Contact author e-mail: nicolae.secrieru@cnts.utm.md

***Abstract* — This paper presents a brief overview of the first Moldavian satellite – TUMnanoSAT designed at the Technical University of Moldova Space Technology Center, included in KiboCube Program. In the paper are described educational missions of this nanosatellite and overall system overview, including: structure, electrical power supply, processing and data management and telemetry communications.**

Keywords — nanosatellite, International Space Station (ISS). Japan Aerospace Agency (JAXA), KiboCube module, United Nations Office for Outer Space Affairs (UNOOSA)

I. INTRODUCTION

The National Center for Space Technologies (NCST) of Technical University of Moldova (TUM) has been oriented towards a series of nanosatellites, according to the international standard CubeSat [1-8]. In 2019, NCST participated in the fourth round of the KiboCUBE Program with the nanosatellite "TUMnanoSAT" [9].

KiboCUBE Program is a collaboration between UNOOSA and JAXA that aims to provide to the United Nations Organization members opportunity to launch CubeSat satellites developed for educational and research purposes.

The NCST team was selected by the Japan Aerospace Agency (JAXA) and the United Nations Office for Outer Space Affairs (UNOOSA) for the fourth round of the KiboCUBE Program for the launch of the TUMnanoSAT nanosatellite from the International Space Station (ISS) in 2020, with the Japanese experimental KiboCUBE module.

The Japanese Space Agency's Kibo module on the ISS was designed to be used as both a microgravity laboratory, as well as a launch pad for low-Earth-orbit services. This ISS module includes a small satellite-deployment system called the J-SSOD. Deploying nanosatellites from ISS has a number of benefits. Launching the vehicles aboard the logistics carrier of ISS visiting vehicle reduces the vibration and loads they have to encounter during launch. In addition, they can be packed in protective materials so that the probability of CubeSat damage during launch is reduced significantly. In addition, the lower orbit allows a natural decay of the satellites, thus reducing the build-up of orbital debris [11].

KiboCube program for The National Center for Space Technologies (NCST) of Technical University of Moldova (TUM) has a major impact on the improvement of the quality of engineering studies based on modern space technologies, attracting young students to develop and strengthen scientific research in space exploration. The scope of this paper is to present the conceptual architecture and overall system overview of TUMnanoSAT, to describe software and hardware modules for the implementation of nanosatellite.

II. TUMNANOSAT SETUP AND OVERALL SYSTEM

NCST of TUM, focusing on the international standard CubeSat, decided to develop a series of satellites with specific and efficient missions. For the first mission – TUMnanoSAT our primary objective is to verify under real conditions the functionality of the various satellite modules and subsystems for future missions. The basic missions of these satellites are:

- testing of nano-structure sensors in space conditions
- to establish effective communication subsystem "satellite-ground station" with the possibility to modify the communication rate range and ensure high reliability;
- to check the communication protocol "satellite-ground station" with different levels of access;
- testing of power supply system and the search for the optimal modes of accumulated energy distribution;
- testing of sensors subsystem for satellite attitude determining (magnetometers, micro-gyroscopes, sun sensors) in order to optimize process control satellite attitude;
- testing of the COTS electronic components operation in conditions of radiation, including the onboard computer, digital memories.

A. Nanosatellite structure

The main purpose of the structural subsystem is to provide a rigid, reliable structure that would withstand all harsh launch conditions. Also the main idea in structural subsystem designing is maximizing usable interior space while minimizing the complexity of subsystem.

The basic constraints imposed to TUMnanoSAT structure are given by the CubeSat Design Specifications [8] and JEM Payload Accommodation Small Satellite Deployment Interface Control Document.

Following these standards, TUMnanoSAT dimensions are 100 mm x 100 mm x 113.5 mm.

The material use in TUMnanoSAT sctructure is aluminum alloy 6061. Also due to the fact that TUMnanoSAT is designed

978-1-7281-5611-8/20/$31.00 ©2020 IEEE