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SPACE SYSTEMS SYMPOSIUM (D1)
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Author: Prof.Dr. Josue lopez
Mexico, josue.lopez@cetys.mx

Ms. Veronica Tamai
Student, Mexico, veronica.tamaii@gmail.com
Mr. Felix Najera
Center for Technical and Higher Education (CETYS University), Mexico, felixinho@gmail.com
Mr. omar castañeda
Center for Technical and Higher Education (CETYS University), Mexico, mariocr21@gmail.com
Mr. jose torres
Center for Technical and Higher Education (CETYS University), Mexico, torres06_1190@hotmail.com
Mr. Juan Zarama
Center for Technical and Higher Education (CETYS University), Mexico, cacarlos8@hotmail.com

A PLATFORM FOR SMALL SATELLITES FOR QUANTUM COMMUNICATIONS AND CRYPTOGRAPHY: CONCEPTUAL DESIGN AND PRELIMINARY RESULTS OF QCOMSAT PROJECT.

Abstract

This paper presents the QComSat project developed by The Center of Excellence in Innovation and Design (CEID) which is part of the Center for Higher and Technical Education (CETYS University) in Mexico. The project consists of the design, simulation and construction of a complete satellite system for performing simulations and proof-of-concept in order to improve the aspects concerning to the technologies and subsystems used in small satellites. In roughly speaking, the QComSat project consists of two small satellites for academic and research purposes for quantum optical communications; the complete system will have the option of small satellites to be implemented in a pneumatic (1-axis) and mechanical (2-axis) stabilization systems. The objective of the stabilization control system is the possibility of simulating different scenarios, i.e. ground-space (ground station-spacecraft) and space-space links (spacecraft-spacecraft). Also, the stabilization system will help to improve the performance of the TAP system (Tracking-Acquisition-Pointing). Currently, the conceptual design was developed considering the following subsystems: mechanical structure, communication and control, power, quantum optical payload and stabilization. On the other hand, the subsystems of power, telemetry, communications and structure are the most advanced subsystems in a technical way. The power subsystem consists of four power solar panels; therefore, the complete mass of the spacecraft is 453.56 grams without considering the optical payload. With respect to the power system, it has a total capacity of 9 Watts (considering only the power of the solar panels) which are used only 2.5 W, due to the consideration of future payloads. However, the power supply is designed with power demands from 0.5–15 Watts considering a lithium ion battery pack. The on-board computer consists of an Arduino Pilot which has the purpose of monitoring some physical variables (temperature, humidity, orientation, etc.) of the overall satellite and external environment in order to maintain the adequate operational conditions of the complete subsystems. In addition, it was established a radio frequency link at a distance of 1.2 km in order to determine general performance parameters (bit rate, bit error rate, SNR). Additionally, we present the preliminary conceptual design of the quantum optical payload using weak coherent states. The QComSat project short-term goal is the integration of the overall subsystems using the CubeSat standard.