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CONCEIVED, DESIGNED AND CONSTRUCTED BY STUDENTS: A CANADIAN NANO-SATELLITE FOR SPACE PHYSICS RESEARCH

Abstract

Total Electron Content (TEC) is an important quantity which is used to investigate the naturally occuring plasma processes in the near-Earth space environment. TEC is a measure of the dispersion properties of this complex plasma in the near-Earth space environment. The dynamics and properties of the plasma is largely defined and controlled by the interaction of the magnetic fields of the Earth (geomagnetic field) and Sun (Interplanetary Magnetic Field or IMF). On the Earth's surface, important human infrastructure — such as telecommunications networks, electrical grids, and petrochemical pipelines — are extremely vulnerable to the dynamic nature of the near-Earth space plasmas. This infrastructure has experienced devastating negative effects due to severe 'geomagnetic events' in the past. As society becomes more dependent on this infrastructure, it becomes even more imperative that these complex interactions and processes are better understood. TEC measurements offer an advantage to study these

processes by contributing measurements on a global-scale. The relatively low cost of miniature satellites have made them an attractive investment for near-Earth research, including applications to near-Earth space physics research. To provide insight into the near Earth space environment, a 3-U cube nano-satellite has been designed for the Canadian Satellite Design Challenge (CSDC), to perform scientifically relevant TEC measurements. The satellite was conceptualized, designed and constructed by the University of Saskatchewan Space Design Team (USST) — an organization operated by, and comprised primarily of, undergraduate students. The main payload of the satellite is an instrument which will provide global TEC measurements of the ionosphere. The payload will measure the dispersion of radio-waves from a network of ground-based transmitters. In this presentation, a basic description of the CSDC competition and USST satellite design will be presented. In addition, some of the challenges faced by the USST while designing and constructing the scientifically viable satellite, within the competition parameters of a 10 cm x 10 cm x 30 cm volume, 4 kg mass limit, and 2 year time-frame, will be discussed.