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PIC.A.S.S.O: A STATE OF THE ART CUBESAT

Abstract

PIC.A.S.S.O. is highly ambitious, 3U CubeSat science mission with the objective of studying the ozone distribution of the atmosphere, characterize the temperature profile of the mesosphere and the electron density in the ionosphere. In order to achieve these objectives, PIC.A.S.S.O will fly two main payloads: a sweeping Langmuir probe and a visible and near-infrared hyper-spectral imager. The nature of the payloads and their demanding requirements in terms of platform performance means that this mission is arguably one of the most advanced spacecraft with a mass of less than 5kg ever produced. The mission is administered under the European Space Agency (ESA) within the frame of the General Support Technology Programme (GSTP) and represents pan Europe consortium including science, payload and platform specialist organizations. Although not part of the QB50 constellation, the mission will share a ride to orbit on the same Cyclone-4 launch vehicle as that QB50 constellation, with an expected launch timeframe of Q1 2016.

In addition to the key science objectives of the mission, PIC.A.S.S.O. aims to demonstrate the ability of small satellites to carry out actual scientific experiments. Importantly, as an ESA mission, successfully demonstrating the ability to achieve significant science goals on an extremely low-cost platform would potentially open the door to ESA utilizing spacecraft of this class for future missions and applications. This paper will discuss the science instruments and objectives, highlighting the importance of this data to the science community. In addition, the demands on the spacecraft platform resulting from the payload requirements will be explored and the spacecraft design that is being used to meet these requirements within the confines of a 3U CubeSat.

The most demanding of these requirements come from the Hyper-spectral imager (HSI). The HSI must be pointed at the Sun when entering and exiting eclipse for the purposes of imaging the atmosphere at various altitudes. This requires a highly capable attitude determination and control system so as to control the spacecraft in 3 axes whilst achieving fine pointing in eclipse and sunlight. PIC. A.S.S.O. is an exciting CubeSat mission that has the potential to set the benchmark for performance of tiny spacecraft whilst also proving to the space community in general that CubeSats do offer an valid opportunity to all users of space to achieve demanding objectives, at low cost and without compromising performance