

SPACE DEBRIS SYMPOSIUM (A6)
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UNISAT-5: A MICROSATELLITE FOR SPACE DEBRIS MONITORING

Abstract

Space missions must take into account a relatively new threat, which is represented by space debris. This problem has arisen in the last 25 years and requires specific strategies for mitigation, with the main intent of avoiding collisions between orbital debris and spacecraft. Space debris monitoring and orbit determination is an essential premise to this task. In the last decade GAUSS has been involved in optical space debris surveillance, participating to the IADC joint observation campaign and manufacturing the first Italian observatory completely dedicated to space debris monitoring. GAUSS has been also a pioneer in educational microsatellites, namely with UNISAT, EDUSAT and UniCubeSat-GG missions. Combining these two experiences GAUSS students and researchers are designing a microsatellite with a compact digital imaging system on board. The UniSat-5 mission purpose will be space debris monitoring, taking advantage of an in situ observation above Earth's atmosphere. One of the key elements of observing on orbit is that many atmospheric phenomena would be avoided, such as diffraction and EM absorption. Hence images would gain more contrast and solar spectral irradiance would be higher for the whole visible spectrum. The system is composed of a Schmidt-Cassegrain reflector, a camera, C band and S band transceivers and two antennas. The system is independent from the rest of the spacecraft. The camera is equipped with a panchromatic 5Mpix sensor. The transceivers and their custom-designed antennas operate on ISM 2.4GHz and 5GHz Wi-Fi bands, and Unisat-5 OBDH can switch between the two. The ground segment is composed of a high gain antenna dish, which will be used to establish a TCP/IP wireless link. Every component of this system is an off-the-shelf product. The space debris observation will work in pair with the attitude determination system, as well as the orbit determination system. A dedicated software will provide information on the amount of possible observable targets. The high relative angular velocities and the consequent too short arc will provide data for a rough initial orbit determination. Further observations with the correlation of the targets are required to better estimate the orbit. UniSat-5 micro-satellite will be launched during Q4 2012 by a Kosmotras DNEPR LV; it will be injected in a Sun Synchronous Orbit. UniSat-5 will be the first university satellite for space debris monitoring, and it will test the technology for the future design of a formation flight for on orbit optical debris detection.