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P-GRESSION: A COST-EFFECTIVE CUBESAT PAYLOAD SOLUTION FOR EARTH'S REMOTE SENSING

Abstract

The 3STAR program is an educational project which is being carried out at the Politecnico di Torino in the framework of the GEOID initiative, offered by the Education Office of the European Space Agency. 3STAR will be one of the nine 3U Cubesats of the GEOID (GENSO Experimental Orbital Initial Demonstration) constellation, and it will act as a data-relay platform within the GEOID/HUMSAT mission and a space-based test bed for an Earth's Remote Sensing experiment. This experiment will be performed by the P-GRESSION payload (Payload for GNSS REmote Sensing and Signal detectION). It will try to demonstrate the feasibility of existing applications based on observations carried out by costly and operative space receivers.

Two concepts will be tested. The first one is a twofold GNSS (Global Navigation Satellite Systems) Remote Sensing experiment: 1) the GNSS Radio Occultation experiment, for the profiling of atmospheric refractivity, temperature, water vapour and electron density, which are very important for climate and meteorological purposes, and 2) The GNSS reflectometry experiment for the land and sea surface parameters sensing, which exploits GNSS signal reflected from the Earth's surface. Drought monitoring, farm production, irrigation planning, flood protection, fire prevention, and meteorological forecasts can take advantage from retrieved soil moisture content. Detected sea-surface winds could help to identify adverse meteorological conditions far from coastal zones. Sea altimetry measurements could be used to monitor tides and to identify natural hazards (i.e. tsunamis). Sea-ice topographic changes in the Arctic and Antarctic regions and dry ice stratification could be monitored in order to improve polar climatology knowledge. It is worth noting that, for both these GNSS-based experiments, global world coverage of observations is assured in all weather conditions. Finally, the current development/improvement of future global GNSS systems like the European Galileo, will enlarge the number of offered GNSS signals, improving consequently the resolution in time and space of the remote sensing observables.

The second concept is based on signal identification. In particular P-GRESSION will acquire signals coming from ground-based radars, in C and/or X frequency bands, both for detection and for calibration purposes. Both experiments will be based on a Software Defined Radio approach, since after standard radio acquisition with low cost front ends and antennas, all operations will be performed by software.

This contribution will give an overview of the architecture and the scientific applications of this cost-effective payload, opportunely tailored for Cubesat missions.