SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Near-Earth and Interplanetary Communications (4)

Author: Prof. Otto Koudelka
Graz University of Technology (TU Graz), Austria

Dr. Manfred Wittig
European Space Agency (ESA), retired, The Netherlands
Mr. David Evans
European Space Agency (ESA), Germany

ADVANCED PROCESSING AND COMMUNICATIONS PAYLOADS FOR NANOSATELLITE MISSIONS

Abstract

Small satellite missions are currently booming. They offer interesting possibilities to test, demonstrate and validate novel technology in Space at low cost and within much shorter timeframes than traditional Space missions. TU Graz has been selected as Prime Contractor for OPS-SAT, an ESA nanosatellite mission to test novel operational concepts and to provide a laboratory in Space for conducting hardware and software experiments covering among others the areas communications protocols, autonomy, attitude control, RF and optical communications as well as remote sensing. While the common perception of Space missions is that most novel technology is utilised, the fact is that in particular the utilised processors are quite old. The reason is risk aversion which is good for reliability, but not for driving innovations. For OPS-SAT a state of-the-art processing platform based on an Altera Cyclone-V system-on-chip (SoM) module has been chosen. This SoM provides two ARM-9 processor cores and a large field-programmable array which provides reconfigurability for hardware-related experiments. It is a COTS industrial-grade component. To provide the required reliabilty four such modules are planned to be implemented in cold redundancy. Radiation tests are currently scheduled at ESTEC. This SoM module will be used for software experiments as well as the processor for the software defined radio front-end and an optical receiver which are payloads on board of OPS-SAT. The FPGA is utilised for the time-critical algorithms, whereas the ARM-9 processors are active for computational-intensive tasks. The paper describes the OPS-SAT concept and focuses on the re-configurable processor core as well as the interfacing to the various payloads of opportunity.