SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advanced Technologies (1)

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THE FRONTIER RADIO: COMMON SOFTWARE DEFINED RADIO PROCESSING PLATFORM FOR MULTIPLE SPACE MISSION CLASSES

Abstract

The largest benefits of software defined radio technology to the space community are requirement flexibility and mission-to-mission reuse of existing hardware. Achieving these time and cost saving benefits in a radio instantiation is balanced against size, weight, and power (SWaP) resource utilization. A software defined radio processing architecture has been developed, under the JHU/APL name Frontier Radio, which allows flexible scaling of these trades without significant hardware, firmware, or software modification. This design allows the Frontier Radio platform to span multiple mission classes and rapidly infuse new technology as it is developed. The key aspect to the SWaP saving design is the system-on-chip (SoC) integration of the various digital processing elements, which has been made possible by current field programmable gate array (FPGA) space grade technologies. Further advancements in FPGA technology will allow extensive upgrades to the Frontier Radio processing architecture, and allow it to be integrated together with other subsystems (main computer, guidance and control, power management, instruments, etc.) in one location. This paper describes the main capabilities and features of the Frontier Radio processing platform, specific to current flight missions, and how the architecture can be extended across many mission sets to improve communication capability while reducing resource utilization and cost per mission. Extrapolation of the processing design methodologies used in the radio firmware are discussed to enable very low SWaP cube satellites, landers, and probes.