The RadSat Computer Platform is Based on a Xilinx Artix-7 FPGA.
detected by the TMR voter or scrubber), the damaged tile is replaced with a known good spare and foreground TMR operation continues. The damaged tile is repaired in the background by reinitializing its configuration memory through partial reconfiguration. This approach mitigates single event upsets (SEUs) in the FPGA circuit fabric in addition to single event functional interrupts (SEFIs) in the configuration memory. The advantage of this approach is that foreground operation can continue while the faulted tile is repaired and reintroduced into the system in the background, thus increasing system availability.

This approach has been implemented on an Artix-7 200T FPGA with 9 MicroBlaze soft processors. This 0.28µm processor implementation has achieved a performance of 234 Million Instructions Per Second (MIPS) at 1 watt of power consumption. This represents a significant improvement in both performance and power efficiency compared to more widely adopted radiation hardened computer systems. The 0.28µm process node inherently provides 500+ kilorad of Total Ionizing Dose (TID) immunity. The SEU/SEFI fault mitigation approach has been shown to provide a 90x improvement in mean time to failure (MTTF) compared to using Triple Modular Redundancy (TMR) with scrubbing alone on an equivalent process node.

The RadSat computer system is architected such that the fault mitigation procedures are abstracted from the developer. The computer system simply appears as a soft processor-based computer system with all of the flexibility inherent in implementing such a system on a programmable fabric. TID immunity is inherently provided through the 0.28µm process node and SEE immunity is provided by the tile replacement procedure in the background.

RadSat directly contributes to multiple needs called out in the NASA Technology and Processing Roadmap. These include the need for "ultra-reliable, radiation hardened platforms which, until recently, have been costly and limited in performance" and "innovative computing architectures to meet the needs of both science and engineering and emphasizes the need for scalable processing platforms that include intelligent fault-tolerant technologies to increase the robustness of computing platforms for long-duration missions."

The RadSat computing system has been developed at Montana State University in collaboration with the NASA Goddard Space Flight Center.

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For more information about the SSTP, visit: http://www.nasa.gov/smallsats

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RadSat will be deployed through the NASA CubeSat Launch Initiative as a 3U CubeSat. RadSat will leverage existing flight avionics that MSU has developed for the FIREBIRD-II satellite, which was deployed on ELaNa X.