Terrestrial-based Radiation Upsets:
A Cautionary Tale

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Problems with terrestrial-based neutron radiation from cosmic rays have become more commonplace. While the incident rate from neutron radiation is low when compared to space-based radiation, physics, system design and system locations have combined to make systems more vulnerable. FPGA systems are particularly sensitive to neutron radiation, as the FPGAs, microprocessors and memory are all sensitive to upsets. We are interested in reconfigurable supercomputers,which are expected to be highly reliable and highly available despite being very vulnerable to radiation. In this paper, we estimate the error rate for FPGAs, memory, and microprocessors so that predictions for the sensitivity of the Cray XD1 reconfigurable supercomputer can be made. We also present mitigation methods that are appropriate for neutron radiation upset rates.