PROTON IRRADIATION TOLERANCE OF InAs QUANTUM DOTS IN GaAs SOLAR CELLS FOR SPACE APPLICATIONS. ***S. Polly,*** *S. Hubbard, C. Cress, R. Raffaelle, NanoPower Research Laboratories,* *sjp5958@rit.edu*, *rprsps@rit.edu*

Photovoltaic cells utilized in space applications must exhibit a high specific power (W/kg) due to the significant costs per kilogram of placing a satellite in orbit, in addition to high radiation tolerance, as the cells are exposed to high energy particles. In today's state of the art space solar cells, specific power has been increased through efficiency improvements using vertically stacked multi-junction solar cells; however, the middle junction of the InGaP/GaAs/Ge stack limits the power output in this series connected structure. To increase the current produced by the GaAs cell, InAs quantum dots (QD) can be inserted into the intrinsic region of the p-i-n diode. This nanostructured material modifies the band structure of the bulk GaAs, enabling it to absorb lower energy photons thereby increasing current generation within the entire triple junction stack. Though this enables a boost in efficiency, the effect of QDs on the radiation tolerance of the middle p-i-n GaAs must be investigated. GaAs diodes were grown by organometallic vapor phase epitaxy, at NASA Glenn Research Center, with and without strain compensated InAs quantum dots. The wafers were then processed into devices using standard photolithographic, thermal evaporation, lift-off, and chemical wet etch techniques. The processed cells were subjected to 4.5 MeV proton irradiation with increasing displacement damage dose. Cells were characterized before and after irradiation by illuminated J-V curves using a Xe arc-lamp simulating 1-sun AM0 conditions, as well as spectral response (SR) using a spectroradiometer. The structures containing QDs showed an improved open circuit voltage radiation tolerance over the baseline device, with comparable short circuit current density tolerance. This enabled the QD cell to have a larger power output at end-of-life compared to the non-QD device. The SR was used to compare the rates of degradation of the two types of devices, which indicated improved radiation tolerance in the QDs versus the bulk GaAs. The results of this study, with regard to enhanced radiation tolerance and improved specific power by the incorporation of QDs, will be discussed.