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Advances in Ultra-low power, Highly Integrated, Active Pixel Sensor CMOS imagers for Space and Radiation Environments

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Abstract: Given the ever increasing need to develop more cost-effective future satellite and spacecraft systems, instrument and avionics payloads are evolving into smaller, lighter-weight and more power efficient modules. Many of NASA's future missions also require that these lighter weight systems, that do not have the shielding mass margins of previous instruments, must also operate at cryogenics temperatures in stressing multi-megarad radiation environments exemplified by planned mission's to Jupiter's moon Europa. To support these efforts, JPL has been exploring several approaches to improving the radiation performance of Active Pixel Sensor (APS) CMOS focal plane arrays (FPA) for ultra-low power, "smart" science imagers, star trackers, boom/antenna deployment cameras and optical communications beacon tracker focal planes for the next generation of unmanned interplanetary and deep space exploration missions. Active Pixel Sensor CMOS imagers (made in 0.5 micron design process) are being designed and investigated that can be adaptively windowed with low power on-chip control & timing as well as provide digital output to effect data-channel efficient on-chip preprocessing, with no blooming and wide dynamic range. This presentation will give the status of the work in the development these radiation-robust, ultra-low power photodiode and photogate active pixel sensor designs.

Author Bio: Dr. Robert Stirbl is a Senior Member of the Engineering Staff in JPL's Advanced Imager and Focal Plane Technology Group and has 30 years of academic and industrial experience with electro-optical system for AT&T, Allied-Bendix, Northrop-Grumman, and Riverside Research Institute. He has designed, and managed the development of several space remote sensing and optical metrology systems. Dr. Stirbl has published over fourteen papers, and he holds 12 US patents. He is currently manager for several government agency programs to adapt Ultra-low power, "sensor-on-a-chip" CMOS imagers for DoD, NASA, medical, and industrial applications.