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Issues for Radiation Assurance Validation at Jupiter's Moon, Europa.

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Missions to Europa and other moons of Jupiter will experience the most severe radiation environment in the Solar System. Although several spacecraft have rapidly passed through this environment, no spacecraft has been flown continuously in such an environment. The proposed mission to Europa, however, will spend a continuous month or longer in this environment. As mission plans have proceeded, new assurance issues have arisen.

These issues include: A factor of two or more uncertainty in the radiation environment produces factor of two or more uncertainty in mission duration, now planned at one month. Large uncertainty in the very high-energy proton and electron environment causes large uncertainty in the effectiveness of radiation shielding, and produces extreme launch-mass penalties. Rapid dose degradation of electronics creates requirement for more rapid data collection, but faster instruments may be more sensitive to radiation. A single safe-hold could doom the short mission as radiation continues to degrade systems while ground personnel devise fixes. Thus the safe-hold process becomes a dramatic part of the assurance equation and must be streamlined. Uncertain radiation charging and discharging test results indicate ESD pulsing amplitudes and pulsing rates threaten the newer ESD-sensitive electronics. Proposed ESD solutions are only partially tested and are unfamiliar to most systems designers.

As a result of these issues, risk/design tradeoffs will be difficult to quantify for the Europa mission and pose a unique challenge for radiation assurance techniques.

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