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Correlation of ISS Electric Potential Variations with Mission Operations

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Spacecraft charging on the International Space Station (ISS) is caused by a complex mix of the low Earth orbit plasma environment, space weather events, operations of the high voltage solar arrays, and changes in the ISS configuration and orbit parameters. Measurements of the ionospheric electron density and temperature along the ISS orbit and variations in the ISS electric potential are obtained from the Floating Potential Measurement Unit (FPMU) suite of four plasma instruments (two Langmuir probes, a Floating Potential Probe, and a Plasma Impedance Probe) on the ISS. These instruments provide a unique capability for monitoring the response of the ISS electric potential to variations in the space environment, changes in vehicle configuration, and operational solar array power manipulation. In particular, rapid variations in ISS potential during solar array operations on time scales of tens of milliseconds can be monitored due to the 128 Hz sample rate of the Floating Potential Probe providing an interesting insight into high voltage solar array interaction with the space plasma environment. Comparing the FPMU data with the ISS operations timeline and solar array data provides a means for correlating some of the more complex and interesting ISS electric potential variations with mission operations. In addition, recent extensions and improvements to the ISS data downlink capabilities have allowed more operating time for the FPMU than ever before. The FPMU was operated for over 200 days in 2013 resulting in the largest data set ever recorded in a single year for the ISS. This presentation will provide examples of a number of the more interesting ISS charging events observed during the 2013 operations including examples of rapid charging events due to solar array power operations, auroral charging events, and other charging behavior related to ISS mission operations.