Abstract *(paper not available)*

The Anomaly of Soil Moisture Active Passive (SMAP) Mission and the Space Environments

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SMAP, or Soil Moisture Active Passive, is an Earth satellite mission that measures and maps Earth's soil moisture content and freeze/thaw state to better understand the links between Earth's water, energy, and carbon cycles and enhance the ability to monitor and predict natural hazards like floods and droughts. The SMAP orbit is a 685-km altitude, near-polar, sun-synchronous 6am/6pm, 8-day exact repeat, frozen orbit. SMAP was launched on January 31, 2015 for a nominal three year mission. Following observatory checkout and commissioning, it produced excellent science data with minimal operational anomalies for approximately 3 months. Then, the spacecraft experienced an in-flight anomaly on July 7, 2015. The immediate observables and the follow-on investigations by a Tiger team indicated a fault of the primary science instrument (L-band radar) with no pulses being transmitted (and no echoes being received) as a result of a failure in the internal circuitry of the High Power Amplifier's (HPA) Low Voltage Power Supply (LVPS). Coincidentally, the anomaly occurred while the spacecraft was on an ascending south to north pass inside a region known as South Atlantic Anomaly (SAA). Therefore, Single Event Effect (SEE) - more specifically Single Event Transient (SET) - due to high-energy trapped protons in the SAA was a prime suspect at the beginning of the anomaly investigation. But, SET due to the SAA protons was ruled out as a possible root cause by an extensive post-anomaly testing and analysis campaign. We also examined several other possible environmental conditions that might have caused the failure of the LVPS: solar protons/trapped particles for total ionizing dose (TID), plasma/auroral electrons for surface charging, high-energy electrons for internal charging, solar activity and cosmic rays for SEE (other than SET), and micrometeoroids and orbital debris (MMOD) for structural damage. For this purpose, we used flight data when available, reviewed the environmental models used in designing the SMAP spacecraft, and performed more detailed analysis as necessary. While the official investigation is being carried out by a NASA-appointed team at the time of this abstract writing (so no official conclusion yet), our preliminary conclusion is that it is highly unlikely the SMAP anomaly was caused by unusual environmental conditions during the mission. All the details of our investigation on the SMAP anomaly and the space environments will be described and discussed in the final presentation.

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