BOSTON UNIVERSITY

SPACE PHYSICS SEMINAR

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Space Weather Impacts on Geostationary Communication Satellites: Telemetry Data Mining

725 Commonwealth Ave.
Thursday, April 04, 2013
Refreshments at 3:30pm in CAS 500
Talk begins at 4:00pm in CAS 502

Abstract:

Our goal is to understand and mitigate the effects of space weather on the performance of geostationary (GEO) communications satellites. It is hard to achieve such a goal without actual anomaly and telemetry data from a commercial communications satellite operator against which to compare widely available space weather observations. We are leading an effort to access commercial telemetry archives. We have begun to analyze sixteen years of archived telemetry data from Inmarsat, the U.K.-based telecommunications company, and we present initial results in this talk.

We focus on two types of operator-identified anomalies: Solid-state power amplifier (SSPA) anomalies, and single event upsets (SEUs). A total of 26 SSPA anomalies and 226 SEUs were experienced by two generations of satellites, Fleet A and Fleet B, from 1996 to 2012. We compare telemetry from the Inmarsat anomalies with space weather observations including data from the OMNI 2 database, Geostationary Operational Environmental Satellites (GOES), Advanced Composition Explorer (ACE) Satellite, Los Alamos National Laboratory (LANL) GEO observations, evolution of the sunspot number, and Kp index, as well as timing (both seasonal, eclipse, and local).

Most SSPA anomalies for Fleet A occur as solar activity declines; Fleet B has not yet experienced a full solar cycle. The average value of Kp remained < 2 over time periods of two days, three days, and two weeks around the time of anomaly for both fleets, which suggests that the anomalies occurred at times of quiet geomagnetic activity, and that they were probably not solely caused by surface charging. Six of the twenty-six SSPA anomalies aboard the Inmarsat satellites occurred at 10 +/- 1.5 days after a peak in the 2 MeV electron flux, which suggests that internal charging may have contributed to these anomalies. We do not find a correlation between solar energetic proton (SEP) events and SEUs for Fleet A; we do not yet have a full solar cycle of data for Fleet B. There is a clear difference in the susceptibility of the two different generations to SEUs.

Understanding these results will guide design improvements and provide insight on the operation of geostationary communications satellites during space weather events. We also will discuss ongoing work developing tools to analyze telemetry data for space weather effects and performance indicators at all times, not just during times of known anomalies.