

Analysis of eddy current generation on the Juno spacecraft in Jupiter's magnetosphere

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The Juno mission to Jupiter, has been in orbit around the gas giant since July 4, 2016 sampling the planet's environment with dedicated particle and fields instruments. Juno's magnetometer investigation consists of a boom with a pair of vector fluxgate magnetometers accompanied by a set of star cameras for accurate mapping of Jupiter's magnetic field. In order to increase pointing stability and control, Juno is spinning with approximately two rotations per minute. Due to the spinning of the spacecraft while traversing the intense magnetic field of Jupiter, eddy currents are generated on the spacecraft. The induced currents modify the measurements of the fluxgate magnetometers onboard and cause a spin modulation which mimics a miscalibration of the magnetometers. Instead of simply perform an in-flight calibration, which would be incorrect, a finite element model is developed to characterize the induced field due to the eddy currents in the vicinity of the fluxgate magnetometers on the spinning spacecraft exposed to Jupiter's magnetic field. Subsequently, the induced field parameters are estimated with the help of a Monte-Carlo method by minimizing the spin modulation in the measured field magnitude. The estimated parameters by the Monte-Carlo agree very well with those predicted by the finite element model. These parameters are used to estimate the signal of the induced field and finally remove it from Juno's magnetic field observations.