Magnetic contaminations of the Nozomi satellite and their influence upon the magnetic field data

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After Nozomi was launched in 1998 magnetic fields have been measured continuously by a 3-axial fluxgate magnetometer (MGF) mounted at the top of a 5-m mast. Because the mast will not be extended before the arrival at Mars in 2004, MGF sensor is located on the surface of the satellite body and suffers a lots of magnetic contamination caused by the instruments onboard the satellite.

Switching on and off of onboard instruments significantly prevent us from deriving the magnetic offset accurately. We empirically derive the magnetic field change in the spin direction from that in the components perpendicular to the spin axis and remove it from the data. We apply the Davis-Smith method to these "cleaned" data and calculate successfully the static offset in the spin direction.

After Nozomi was launched in July 1998 and orbited in a parking orbit around the earth, it was inserted into a trans-Mars orbit in December 1998. Magnetic fields have been measured continuously by a 3-axial fluxgate magnetometer (MGF) mounted at the top of a 5-m mast. Because the mast will not be extended before the arrival at Mars in January 2004, MGF sensor is located on the surface of the satellite body and suffers a lots of magnetic noise contamination caused by the instruments onboard the satellite.

In a satellite many magnets are used and electric current generates time-variant magnetic fields. Before the launch we reduced magnetic contaminations caused by the instruments installed into Nozomi and significantly improved the magnetic environment of the satellite. It is impossible, nevertheless, to remove the magnetic contamination perfectly. We have analysed the MGF data after the launch and made every effort to remove the noise to make the data quality enough high.

Nozomi rotates once per about 8 seconds and it is relatively easy to derive the offset in the components perpendicular to the spin axis. We derive the offset in the spin axis direction by the Davis-Smith method, in which we assume that the total magnetic field intensity does not change. Frequent switching on and off of onboard instruments significantly prevent us from deriving the offset accurately.

We have analysed changes of magnetic field accompanied by the switching on and off using the data after the launch. We empirically derive the magnetic field change in the spin direction from the magnetic field change in the components perpendicular to the spin axis and remove it from the original data. We apply the Davis-Smith method to these "cleaned" data and calculate successfully the static offset in the spin direction.

The statistical result of the MGF measurement suggests that the measured magnetic field matches well with the theory by Parker and previous observations.