Electricity income and expenditure evaluation of Electro dynamics tether for the purpose of the debris removal

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1. A study background and purpose

These days increase in space debris becomes the problem in the low earth orbit. A study to say to remove debris in EDT is accomplished. EDT produces Lorentz force with magnetic field and space plasma and removes debris. However, in the geomagnetic field, the same driving force and electricity are not always provided by a place because there is difference in the size. When the electricity to a bus system could not generate electricity, I could serve it only with the electricity that I accumulated to battery or simulated it.

2.EDT operation principle

Instruction electromotive force produces the EDT system by tether moving the whole magnetic field. And An electric current flows through tether by releasing a collected electron and produces Lorentz force in an electric current and a magnetic field. Lorentz force reduce speed of a space craft.

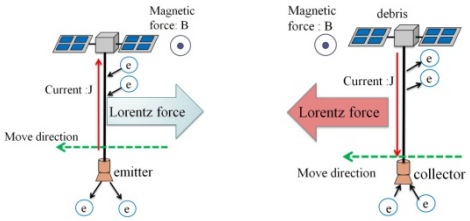

Fig1 deorbit mode, speed up mode

3.Research method

I calculate electricity to occur in tether, From the electricity that occurred, I deduct the electricity of a bleeder and the bus system. I save the electricity for the surplus to battery. I examine a condition to be able to always move the interval bus system which cannot generate electricity under the influence of a magnetic field by simulation. I changed in particular tether length and the generation voltage and examined it this time.

4. Electricity income and expenditure evaluation

Orbit of condition is the orbit with much debris.

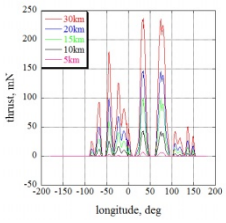

Fig2 thrust

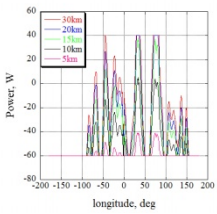

Fig3 surplus power

When driving force of 7.4mN occurs, debris of the 2t grade is one year, and orbit descends from 1,000km to 650km. So If there was length more than 15km, I judged it to be proper as the debris removal. However, the electronic emitter which JAXA develops uses an electric current of 1A verge 100W to drain now. When I deducted it from generation electricity as 10W for this and bus systems, there was not the surplus electric power. I understood that the electricity income and expenditure made ends meet if there were generation voltage 100V, tehter 30km in length if the consumption electricity of the electronic bleeder was 50W.

5. Summary

The electricity income and expenditure makes ends meet if the consumption electricity of the emitter is generation voltage 200V, tether length 40km in the case of 100W. It is difficult that tether length 40km is proper length or judges it so far because 20km of TSS-1R of NASA is maximum as for the tether length that a proof examination on the orbit was conducted. As for me, the performance of the electronic bleeder wants up grade.

6.problem

The real magnetic field is changeable. I consider the change of the magnetic field and simulate it from now on