

P11

デブリ除去における帯電課題の初期検討

The Plan for Investigation of Spacecraft Charging Issue for Space Debris Removal

○奥村哲平、大川恭志、壹岐賢太郎、青山順一、河本聡美(宇宙航空研究開発機構)

○Teppei Okumura, Yasushi Ohkawa, Kentaro Iki, JunIchiro Aoyama, Satomi Kawamoto(JAXA)

導電性テザーを使用したデブリ除去方式について、宇宙機帯電の観点から衛星システム検討の実施を計画している。衛星システムへの影響について以下の二点を 課題として識別している。

- 1: ターゲットであるデブリの帯電電位が、除去衛星接触時に衛星システムに与える影響
 - 2: 導電性テザー伸展後に発生する誘導起電力による衛星電位の変動が衛星システムに与える影響
- 上記、二つの事項につき今後取り得るアプローチと期待される結果について述べる。

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Teppei Okumura, Yasushi Ohkawa, Kentro Iki, Junichi Aoyama, Satomi Kawamoto

Japan Aerospace Exploration Agency

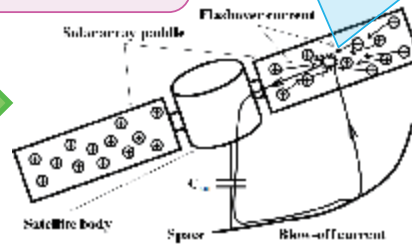
6th Space Debris Workshop, Dec 17 -19, 2014, Tokyo Japan.

What is Spacecraft Charging Introduction

Auroral electron in auroral oval

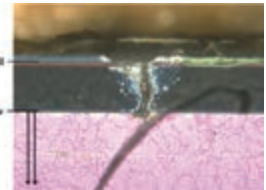
○The spacecraft has negative potential against ambient plasma because the satellite does not have ground.
○The surface has different potential against spacecraft body.

What happens??



The discharge occurs on the surface of spacecraft. The discharge potentially causes anomaly of spacecraft because the discharge current flows into the electric system of spacecraft.

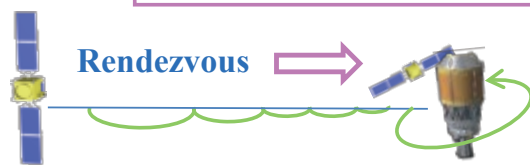
For example??



The above shows the degradation of solar cell due to discharge

Issues

Phase1: Approach to debris (Non-cooperative rendezvous)



Debris Removal Satellite

Phase2: Proximity operations

When debris removal satellite attaches the space debris, the discharge event possibly occurs if the potential difference between space debris and debris removal satellite is high. The discharge potentially causes the failure on the electrical system on debris removal satellite.

Phase3: De-orbit

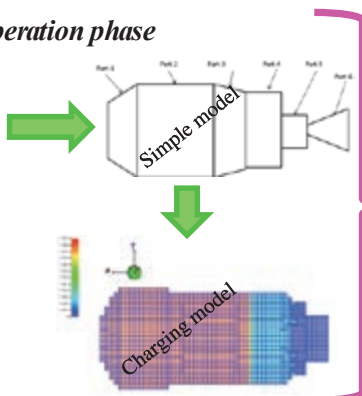
If we use the electrodynamic tether system, the potential of satellite against ambient plasma easily exceeds 100V. Because the threshold voltage for the discharge in low earth orbit is 100V. It might be necessary to design the robust system against spacecraft charging.

Our Approach

Issue at proximity operation phase

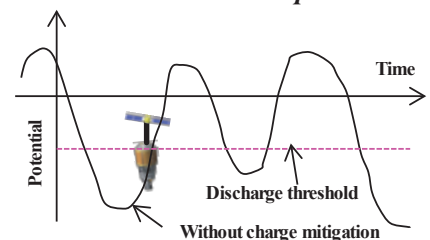


We plan to make the charging model of rocket upper stage for brief estimation of potential against space.



How much charges?
Where is risky position for proximity operation?

Issue at De-orbit phase



We will investigate what kinds of charge mitigation technique is suitable for debris removal satellite.

Summary

- We plan to investigate the issues of spacecraft charging for debris removal program.
- We will propose the design of debris removal satellite based on the result of this research.