

C09

デブリ環境改善に対する MHI の取り組み MHI's Activities to Improve Space Debris Environment

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増加し続けるスペースデブリは宇宙活動の妨げとなり、国際問題となっている。デブリ同士の衝突による更なるデブリの増殖等も危惧されており、このまま増加を放置すれば飛翔中のロケットへのデブリ衝突等によるミッション喪失などのリスクも高まっていくことが想定される。ロケット打上げ事業者であり、宇宙活動の一プレイヤーでもある MHI としても、デブリ対策の取組みが重要であると認識している。MHI では従来 H-IIB ロケット上段の制御再突入等のデブリ対策の取組みを実施してきたが、デブリ環境改善に対する更なる取り組みとして、MHI で検討中の超微小デブリ除去やデブリ同士の衝突回避構想について紹介する。

Space debris have been increasing and recognized as international issue for future space activities. Space debris also increase due to collision between different debris. If this issue is left as it is, the risk of collision between ascending rockets and space debris will increase.

MHI, as a launch service provider and as a player in space activities, recognizes the importance of space debris issue. MHI has been taking actions against space debris issue, such as the controlled reentry of upper stage of the H-IIB rocket. This paper shows the conceptual studies about micro debris removal and collision avoidance between debris as further efforts.



デブリ環境改善に対するMHIの取組み (MHI's activities to improve Space Debris Environment)

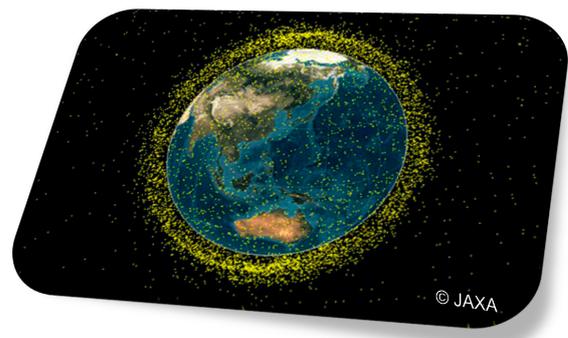
第9回スペースデブリワークショップ

Toyonori Kobayakawa, Masahiro Atsumi, Koji Shimura, Tomohisa Kimura (MHI)
2/26 2021

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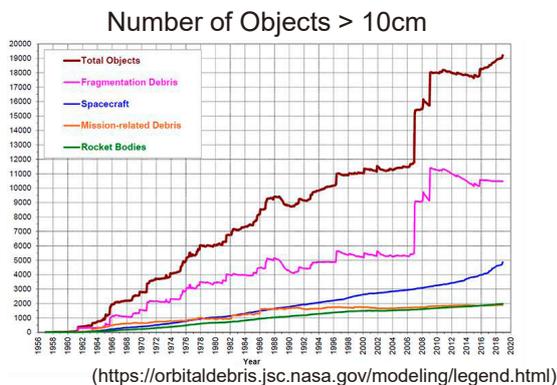


1. Debris and Launch Service
2. Activities to provide sustainable and reliable launch service
3. MHI's Future Plans for Sustainable Space Activities

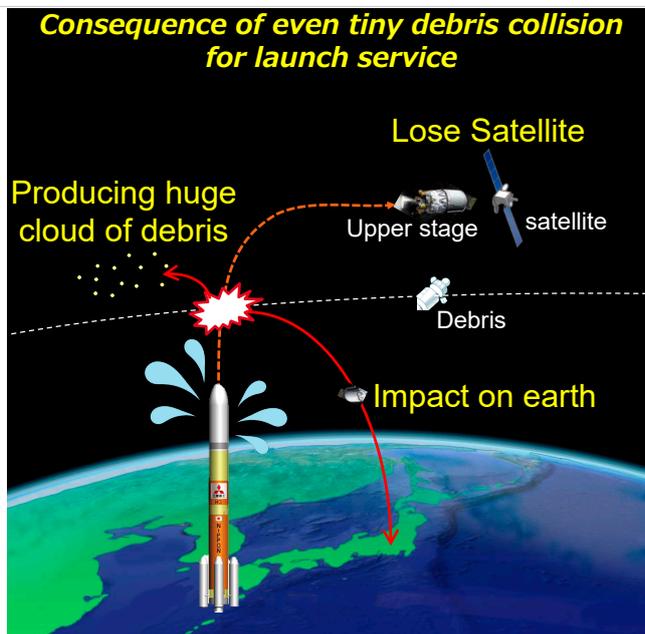


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1. Debris and Launch Service



- ❑ Number of debris is increasing!
- ❑ Estimated Number of non-trackable debris is said to be above 10 million!



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2. Activities to provide sustainable and reliable launch service



MHI's Activities so far

Passivation

- ✓ Venting Residual Propellant

Controlled Reentry (H-IIB)
(All mission successfully completed !!)

What we have to do next ?

Mitigation

- ✓ ADR for trackable debris
- ✓ Micro debris removal

Collision prevention

- ✓ Nudge debris to change orbit and reduce collision probability

First collision accident (2009)
 Iridium33 – Kosmos 2251

Collision produces huge cloud of non-trackable debris

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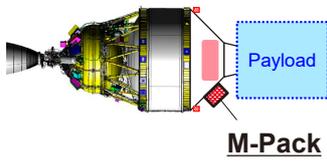
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3. MHI's Future Plans for Sustainable Space Activities

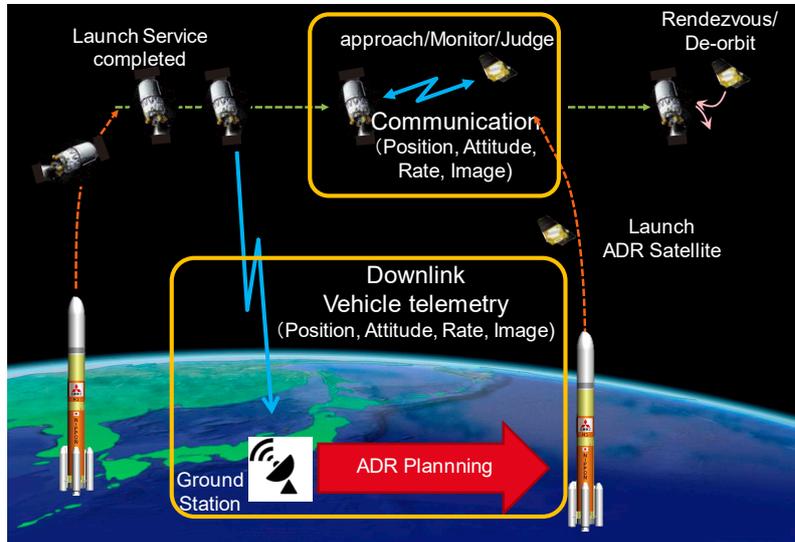


M-Pack and ADR support



- Monitoring Package for passivated spacecraft
- Independent from mission system
- Downlink following data
 - ✓ Position
 - ✓ Attitude Rate
 - ✓ Image

...etc



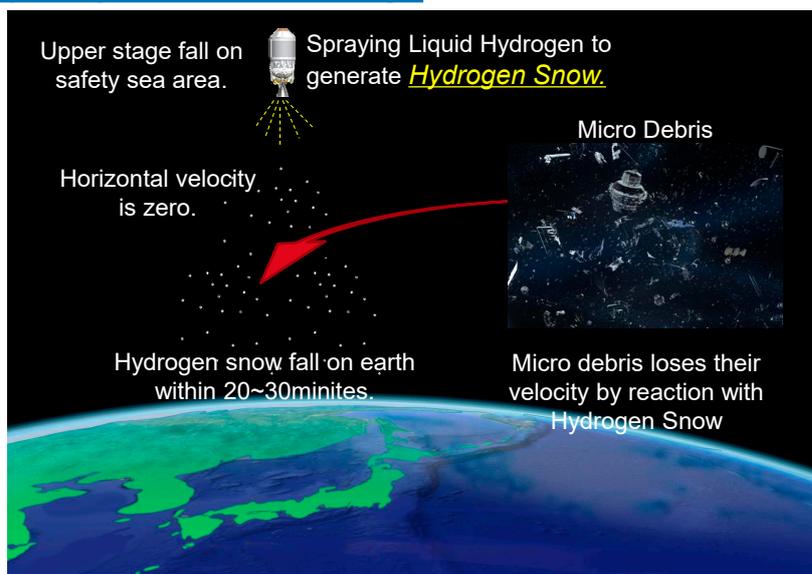
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3. MHI's Future Plans for Sustainable Space Activities



Micro Debris Removal - Hydrogen Snow concept

- Hydrogen is eco-friendly
- Hydrogen does not harm on debris because of low density
- Since hydrogen snow has only vertical velocity, it can remove debris from any direction



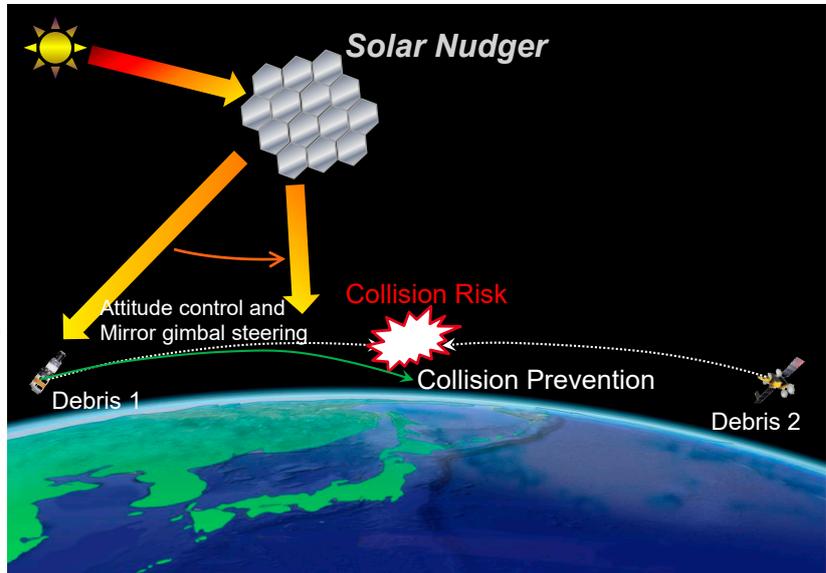
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3. MHI's Future Plans for Sustainable Space Activities



Collision Avoidance – Solar Nudger Concept

- Nudge debris by natural solar pressure
- Solar Nudger does not require
 - Power source to change debris orbit
 - Dangerous rendezvous
- Various application
 - Optical observation during night time
 - Shooting star

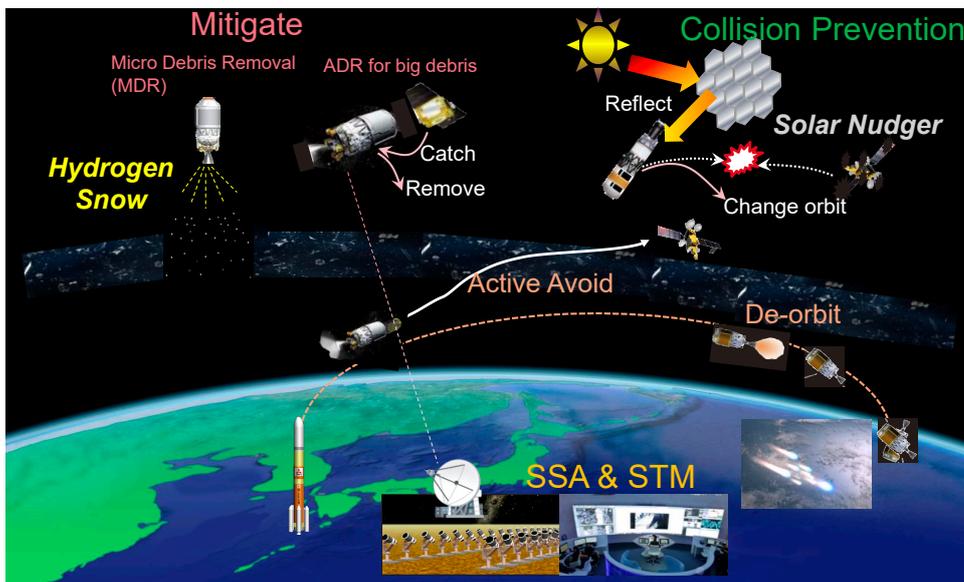


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3. MHI's Future Plans for Sustainable Space Activities



MHI will do all-out effort for sustainable space activities!



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