

## C1

## スペースデブリ総合対策研究チームについて

### Research Team for Space Debris Comprehensive Measures

- 大西 充(JAXA)
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軌道上の宇宙ゴミ(スペースデブリ)は、年々増加の一途をたどっており、将来的には人類の宇宙活動の脅威になると懸念されている。JAXA は、(1)国際標準・ルール化の検討「国際標準化の戦略的推進」、(2)衛星・ロケットの非デブリ化技術の研究「デブリを生まない JAXA 宇宙機」、(3)デブリ除去技術の研究「脅威となるデブリの低コスト除去」、(4)デブリ状況把握・防御技術の研究「JAXA 宇宙機の被害防止」の4つのサブテーマから構成されるスペースデブリ総合対策を担う研究チームを組織し、その脅威に対する我が国の国際貢献策を提唱すべく、政府、内外の関係機関との連携検討を進めることとしている。この研究チームを簡単に紹介する。

The increasing number of pieces of space junk, that is "space debris", is supposed to be a serious threat on humankind's use of outer space in the future. JAXA has organized the research team for space debris comprehensive measures, which consists of following 4 key sub-themes,

- (1) Formulating International Standards and Guidelines
- (2) Researching technologies for debris Mitigation
- (3) Researching technologies for the low-cost Active Debris Removal
- (4) Researching technologies for debris Situational Awareness and Defense

in order to enhance Japanese contribution to sustaining useful outer space environment against the threat, in cooperation with the Japanese government and relevant organizations in the world. In the presentation, the research team will be introduced briefly.

## The 7<sup>th</sup> Space Debris Work Shop

### Research Team for Space Debris Comprehensive Measures

スペースデブリ総合対策研究チームについて

Mitsuru Ohnishi (JAXA)

大西 充（宇宙航空研究開発機構）

### Cross-cutting Research for Future Ensuring the Safety of Space Missions

宇宙活動の安全確保に関する先導的研究

#### Research Objectives

(1) Protecting space assets which are necessary infrastructures for Japan's national security and everyday life of the people, while contributing to promoting sustainable use of outer space environment.

宇宙資産保護および宇宙活動の持続的発展への貢献

(2) Enhancing Japan's initiative against the space debris issue that the world has been tackling, while contributing to the Japanese space industry to gain advantages for future regulatory circumstances.

外交的・産業的国際競争力強化

## **Background(1/2)**

### **Basic Plan on Space Policy**

- **New Basic Plan on Space Policy has been established in 2015 and approved by cabinet in 2016**
  - Promoting the international activities to draw up the ICOC (International Code of Conduct for Outer Space Activities)
  - Improving the capability of SSA
  - Addressing the R&D on debris removing technologies
- **The implementation for the Policy has been revised in December, 2015.**
  - Establishing the framework of SSA in FY2016

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## **Background(2/2)**

### **Japan's Space Activities Act**

- **Japan's Space Activities Act is underway to be enforced at the Diet in June, 2016.**
  - **The Space Activities Act will ease private sectors to make business on the launch services and various space utilizations.**
  - **JAXA continues applying own standard (JMR-003C) for space debris mitigation of our own mission, regardless obligation of JAXA to the Act that will be clarified shortly.**
  - **The regulation for the Japanese private sectors will be discussed in process of enforcement of the national regulation.**

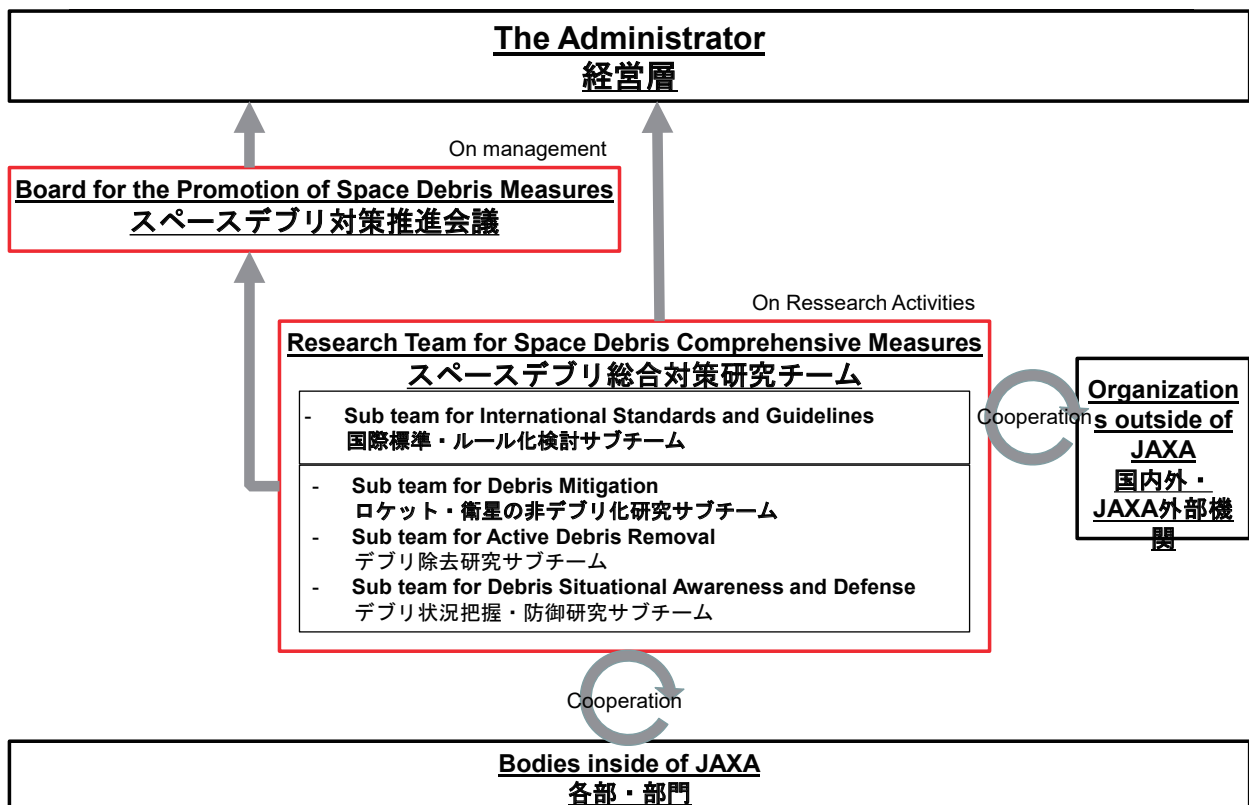
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# Scheme for the Promotion of Space Debris Measures

- **JAXA’s R&D activities for space debris measures**
  - Proposing the technical guidelines for debris mitigation through the activities on IADC( Inter-Agency Space Debris Coordination Committee ).
  - Taking advantage of Japan's strengths and promoting the research and development on the space debris mitigation technologies such as observation, protection and safety removal.
- **Framework for the promotion of space debris measures**
  - Board for the promotion of space debris measures
    - Under construction
  - Research team for space debris comprehensive measures
    - The team consists of 4 sub-teams.

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## Scheme for the Promotion of Space Debris Measures



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## Research Team for Space Debris Comprehensive Measures

- **Leader: M. Ohnishi, Mrs. S. Kawamoto**
- **Sub-teams for**
  - Formulating International Standards and Guidelines
  - Researching Technologies for Debris Mitigation
  - Researching Technologies for the low-cost Active Debris Removal
  - Researching Technologies for Debris Situational Awareness and Defense

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## Formulating International Standards and Guidelines (1/2)

- Making efficient proposals, in cooperation with other spacefaring agencies, on international standards or guidelines for space debris mitigation, actively adopting the latest technologies and the findings in related researches.
- **COPOUS (Committee on the Peaceful Uses of Outer Space: 国連宇宙空間平和利用委員会)**
  - STSC (Scientific and Technical Subcommittee: 科学技術小委員会)
    - LTS (Long-Term Sustainability of Outer Space Activities: 宇宙活動の長期持続性の検討)
- **ICoC (International Code of Conduct for Outer Space Activities: 宇宙活動に関する国際行動規範)**
- **ISO (International Organization for Standardization: 国際標準化機構)**

**“Status of debris mitigation framework and the document system in JAXA to encourage compliance with it” by A. Kato.**

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# Formulating International Standards and Guidelines (2/2)

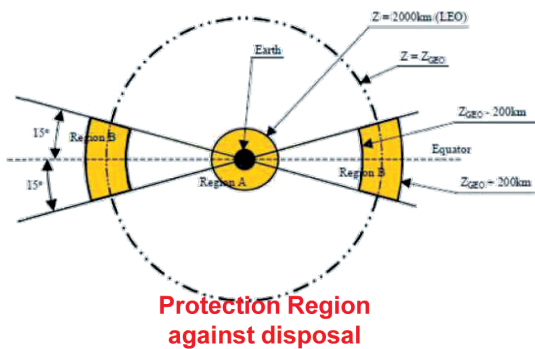
- **IADC (Inter-Agency Space Debris Coordination Committee: 宇宙機関間デブリ調整会議)**
  - **Sub Groups**
    - **Steering Group**
    - **4 Working Groups: Measurements, Environment and Data Base, Protection, Mitigation**
  - the Italian Space Agency (ASI), the Centre National d’Etudes Spatiales (CNES), China National Space Administration (CNSA), Canadian Space Agency (CSA), Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), the European Space Agency (ESA), the Indian Space Research Organisation (ISRO), Japan Aerospace Exploration Agency (JAXA), the Korea Aerospace Research Institute (KARI), the National Aeronautics and Space Administration (NASA), the State Space Corporation “Roscosmos”, the State Space Agency of the Ukraine (SSAU), and the UK Space Agency (UKSA)



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# Researching Technologies for Debris Mitigation

- **Acquiring advanced technologies associated with reduction of orbital lifetime, spacecraft controlled reentry and design for demise such as application of the composite materials on upper stages and propellant tanks.**



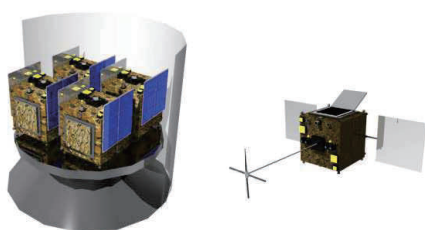
**Using Melting Material during re-entry**

**“Debris mitigation research of rocket and satellite, as JAXA's research” by Y. SAITO, R. Shimizu.**

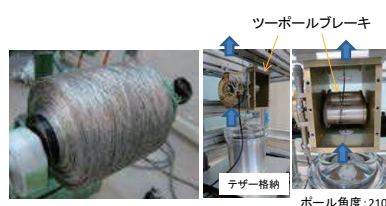
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## Researching Technologies for the low-cost Active Debris Removal

- Acquiring technologies for the low-cost active debris removal around 2020's using Japan's accumulated technologies such as autonomous rendezvous.



Conceptual Study for low-cost ADR



Trial manufacturing of EDT for practical use

“Technology Development in JAXA to Realize Active Debris Removal”  
by T. Yamamoto, ADR research team

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## Researching Technologies for Debris Situational Awareness and Defense

- Acquiring advanced technologies to improve orbit-determination accuracy on collision avoidance maneuvers, to have more effective protection measures, to have more accurate orbital debris modeling, etc.



“Research and Development for Space Debris Situational Awareness and Defense in JAXA” by T. Yanagisawa, et. al

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